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## RESPIRATORY PHYSIOLOGY IN THORACIC SURGERY\*

CLARENCE A. McINTOSH, M.D.

MONTREAL, CANADA

FROM THE DEPARTMENT OF SURGERY, MC GILL UNIVERSITY, MONTREAL, CANADA

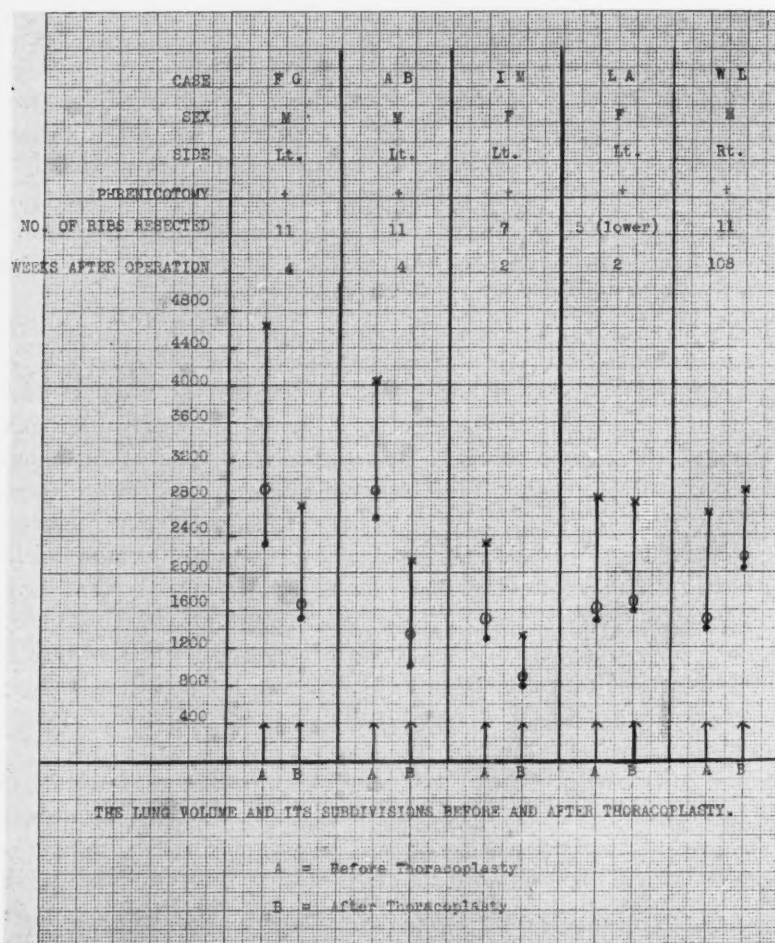
IT is not the object of this paper to describe the physiologic changes that result from all the more common thoracic operations, but rather to demonstrate certain of the respiratory readjustments that follow extrapleural thoracoplasty. Indeed, it is almost amazing, when one reads the literature of thoracoplasty, to find the meager amount of recorded data that deal with the altered respiratory function. In the main, the results of thoracoplasty are looked for in an improvement of the clinical condition of the tuberculous patient—the diminution or absence of sputum, fall of pulse and temperature, freedom from hemoptysis, absence of cough, *etc.* Indeed, from the clinical standpoint, there is still much to be said for bed rest or artificial pneumothorax, as opposed to thoracoplasty, even in favorable cases.<sup>1</sup> It is natural, then, that the therapeutic value of this operation in tuberculosis should be the main issue. Nevertheless, the functional results of such a procedure are not to be overlooked, especially when it becomes apparent that thoracoplasty can change a tuberculous patient, who at bed rest has no dyspnea and indeed little dyspnea on moderate exertion, into a chronic invalid from a respiratory point of view, even though the cough, sputum, bacilli, *etc.*, have been eliminated. If it were left to the patient, it is problematical between which he would choose. From the surgeon's standpoint, his problem in any given case is quite clear. Can the disease be arrested without making the patient worse off physiologically than he was before?

Strange as it may seem, and it is now over 20 years since thoracoplasty for pulmonary tuberculosis came into being as a standard operation, the functional capacity of the apparently arrested cases is not accurately stated. The latest volume dealing with thoracic surgery<sup>2</sup> records the results of over 3,000 thoracoplastic cases collected from the literature, yet a detailed account of the extent of the disease, the amount of rib resection, and the patient's absolute functional capacity after operation, is not to be found except in small isolated accounts. In an attempt, therefore, to record more detailed facts about such cases than is contained in the usual discharge summary of thoracoplasty cases, the following investigations are set forth.

Before recording the facts observed, a few words are necessary to point

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out the impairment of function in ordinary tuberculous cases, more particularly those that are subjected to operation. It has long been recognized that vital capacity is impaired, but in the early stages its reduction is hardly measurable since the normal standards as calculated from the surface area, *etc.*, are relatively unsatisfactory. Methods are now available whereby the total lung capacity, functional residual air and the residual air<sup>3</sup> can be measured with considerable accuracy. From them, the ratio of the functional residual air to the total capacity can be determined, which is found remarkably constant in normal individuals. The limits within which this ratio may fluctuate have



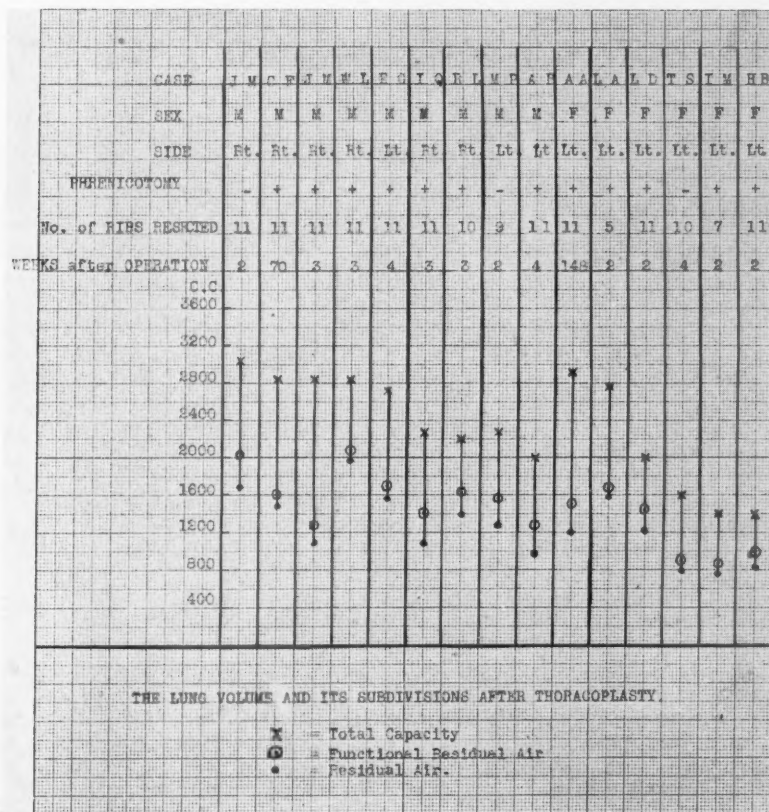
GRAPH 1.—The lung volume and its subdivisions in five cases of pulmonary tuberculosis before and after thoracoplasty.

been established by Hurtado and Boller.<sup>4</sup> With minimal lesions the ratio is at the lower limit of normal, and with more extensive disease it becomes greatly increased. Practically all patients that are subjected to thoracoplasty show at least a slight elevation in the ratio before operation. A more de-



tailed account of the respiratory function in tuberculosis will be published shortly.<sup>5</sup>

*The Lung Volume and Its Subdivisions after Thoracoplasty.*—The following observations have been made on 15 cases of tuberculosis that were admitted to the general surgical wards of the Royal Victoria Hospital for the performance of extrapleural thoracoplasty. In five instances (A.B., E.G., W.L., I.M., L.A.) the lung volume and its subdivisions have been measured before and after operation, while in the remaining ten cases the determinations



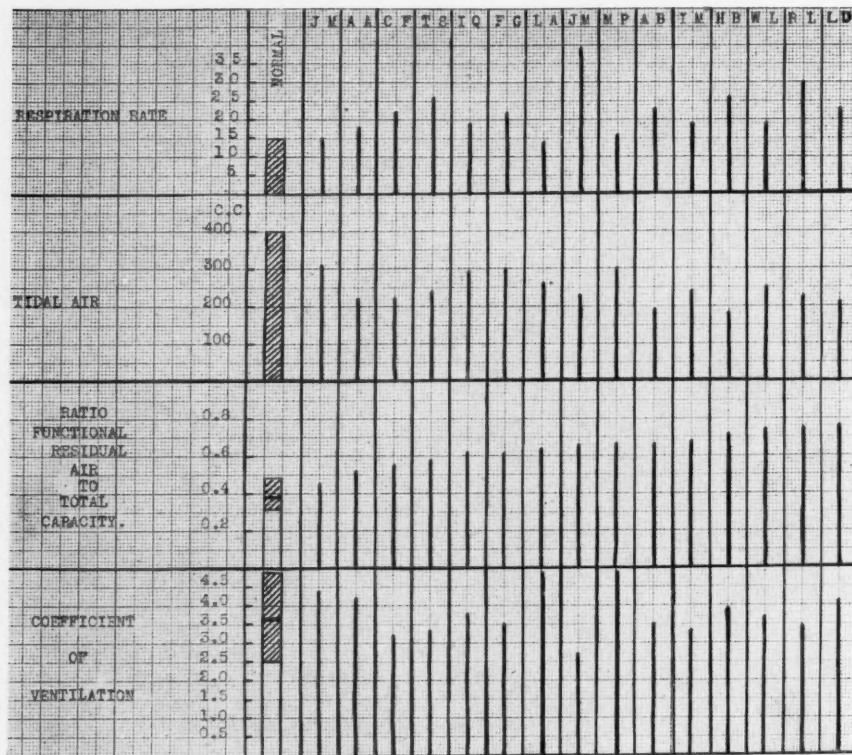
GRAPH 2.—The lung volume and its subdivisions in 15 cases of pulmonary tuberculosis after extrapleural thoracoplasty.

were made only after operation. Except in three instances (C.F., A.B., A.A.) all the measurements have been made within a few weeks of the operative procedure (Graphs 1 and 2).

A great reduction in lung capacity was noted. The total capacity was reduced in every instance to less than 3,000 cc., and in two female patients (I.M. and H.B.) to 1,400 cc. The functional residual air was likewise very definitely reduced and, since the measurement of this quantity is the actual amount of functional lung collapsed by this operation, it is the most important figure to be determined accurately. The functional residual air

and the residual air follow each other very closely. At the lower levels between 800 and 900 cc., the reserve air has become reduced to a few cubic centimeters. The greatest reduction took place in the complemental and reserve air, which is shown in the diminution of the vital capacity (Graph 3).

The ratio of the functional residual air to the total capacity in all instances was well above the average normal. The greater the ratio above the normal, the greater the loss of pulmonary efficiency, for "the efficiency of the pulmonary ventilation would appear to rest upon the relationship between the residual air and the total capacity."<sup>6</sup>



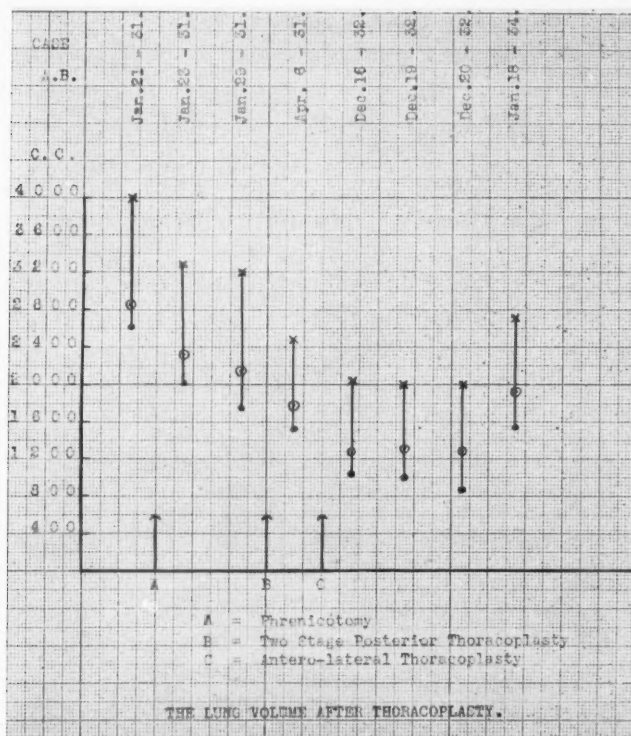
PULMONARY VENTILATION AFTER THORACOPLASTY

GRAPH 3.—Respiratory rate, tidal air, ratio of functional residual air to total capacity and the coefficient of ventilation in 15 cases of pulmonary tuberculosis after thoracoplasty.

In those instances where a period of time has been allowed to elapse between the thoracoplasty and the lung volume determinations, there was a moderate total capacity but still a greatly disturbed ratio (cases A.B., A.A., C.F.). Undoubtedly, the contralateral lung does increase in volume, when the total capacity has risen 750 cc. in a period of two years after operation and this without the resolution of any known exudate in the healthy lung. The effect of phrenicotomy and three thoracoplasty operations in reducing the various subdivisions of the lung volume was definitely noted (Graph 4).

*Hemorespiratory Exchange.*—As the ratio of the functional residual air to the total capacity rises, there is, in a general way, a fall in the tidal air and an increase in the respiratory rate. Any impairment of total oxygen absorption would be clearly demonstrated by a deficiency in the respiratory coefficient, and this really is a vital respiratory function, more so than the total ventilation. The coefficient of ventilation was measured by collecting the expired air in a Douglas' bag over a period of six minutes. In all instances the coefficient was found to lie within the normal variations.

*The Alveolar Air.*—On account of the great diminution in the tidal air,



GRAPH 4.—The lung volume and its subdivisions in a case of pulmonary tuberculosis after phrenicotomy, and thoracoplasty done in three stages.

it was found quite impossible to measure the alveolar air with any degree of accuracy. The pressure of  $\text{CO}_2$ , as determined from the arterial blood, was within normal limits except in two instances.

*The Arterial Blood.*—On nine occasions, the arterial blood gases were analyzed after thoracoplasty. In only two instances was the oxygen saturation above 90 per cent. This is of some importance when one considers that the ordinary tuberculous patient, without acute pneumonic disease, has a normal saturation, as well as a patient under pneumothorax therapy, provided the refills are not too massive. The carbon dioxide content of the serum was in each case within normal limits.

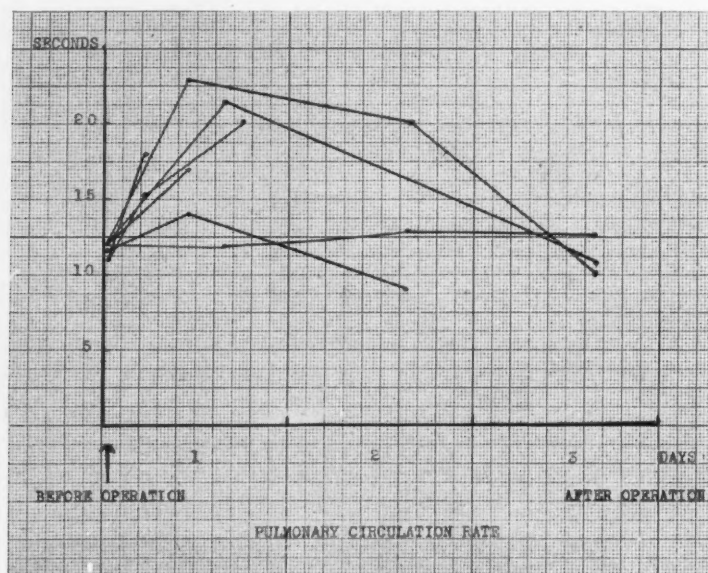
*The Hemoglobin.*—As might well be expected, the hemoglobin, as measured by the oxygen capacity of the whole blood, was definitely below the normal in those cases where the determination was made shortly after the operation. In only one instance was the hemoglobin increased some months after thoracoplasty, as is so often the case following pneumothorax therapy.<sup>7</sup>

*The Metabolic Rate.*—The metabolic rate following thoracoplasty follows the same changes as does any case of pulmonary tuberculosis. Thoracoplasty was not found to have any appreciable influence on the metabolic rate.

TABLE I

*The arterial blood gases following thoracoplasty for pulmonary tuberculosis*

Case	Date	Period after Thoraco- plasty	Oxygen Capa- city vols. %	Oxygen Con- tent	Satura- tion %	Carbon Dioxide			
						Capacity at 40 Mm. pCO <sub>2</sub> vols. %	Con- tent (serum) vols. %	pH	Alveolar pCO <sub>2</sub> Mm. of Hg.
M. P. . . . .	10/ 3/33	Before op.	21.5	19.5	91.0	60.0	59.2	7.35	46.0
M. P. . . . .	11/22/33	16 days	18.2	16.4	90		57		
J. M. . . . .	9/14/33	24 days	16.6	14.8	88.8	56.6	56.6	7.36	43.0
L. A. . . . .	7/12/33	19 days	15.6	13.8	87.2	63.9	63.4	7.42	43.0
W. S. . . . .	10/ 2/31	11 yrs.	16.4	13.2	80.2				
A. B. . . . .	12/21/32	36 days	18.6	16.6	88.9	67.5	61.9	7.40	44.0
C. F. . . . .	2/ 3/33	2 yrs.	25.8	22.5	87.6	57.4	59.9	7.35	47.0
A. A. . . . .	5/23/33	3 yrs.	21.1	19.3	91.3	51.7	52.1	7.37	40.0
I. Q. . . . .	5/25/33	29 days	17.0	15.2	89.4	60.4	62.1	7.4	43.0
L. L. . . . .	6/27/33	14 days	13.4	9.3	69.4	63.0	63.3	7.46	44.5



GRAPH 5.—Pulmonary circulation rate in eight cases of pulmonary tuberculosis following thoracoplasty.

*The Pulmonary Circulation.*—The methods of measuring the cardiac output in man are still subject to so much error that the results obtained from a case with so impaired a respiratory function as results from thoracoplasty as well as tuberculosis would be of no value.

Observations were made on the pulmonary circulation rates in eight cases that were operated upon. A few cubic centimeters of Decholin (de-hydrocholic acid) when injected into the arm vein, can be tasted in the mouth at a relatively fixed period after the injection for a normal individual. This time varies from 10 to 13 seconds. The interval obviously measures more than the pulmonary circulation rate, since the material has to pass from the arm vein to the heart, and from the left ventricle to the taste buds of the tongue and the conscious recognition of that sensation. The number of observations is not great but the tendency to a delay in the circulation velocity is in each case definite. An adequate repetition of this simple test should prove of value (Graph 5).

*Venous Pressure.*—It has been frequently stated that the venous pressure is raised after phrenicotomy<sup>8</sup> and pneumothorax.<sup>9, 10</sup> Lately there has been published an article by Overholt and Pilcher<sup>11</sup> who find the venous pressure frequently raised after thoracoplasty. They consider it a guide in determining when to operate and how much rib resection to do without fear of a stormy postoperative period. They further consider a unilateral elevation of venous pressure a common finding. Our own observations of the venous pressure are not many and the readings have been in each case rather high normals than definite elevations above the normal.

One or two clinical observations might be mentioned that possibly have to do with the pulmonary circulation. It is frequently noticed that the uncollapsed lung, examined roentgenologically, takes on a more dense appearance following thoracoplasty. When this appearance is patchy, it is often thought to be a manifestation of an inflammatory process. In time these patches disappear without the patient going through the usual cycle of symptoms and signs that we associate with a spread in the disease.

Frequently, too, those patients that are subject to hemoptysis bleed after thoracoplasty and occasionally one encounters a tuberculous patient that has never had hemoptysis until after thoracoplasty. These two clinical observations, together with the delayed circulation velocity, are conclusive evidence that there is present in the lungs an extreme passive congestion.

*Pulmonary Distensibility.*—On three occasions a pneumothorax has been induced on the healthy side in patients that were to be operated upon for tuberculosis, even though there were no signs of active disease present. A small quantity of air was injected, 200 to 300 cc. sufficient to be seen roentgenographically and to insure that the pleural space was relatively free of adhesions. The usual negative readings were obtained. Following operation, however, when the patient was again placed in the same position as before operation and the pleural pressure again measured, the pressures



now fluctuated from the negative to the positive zone. This occurred in two instances, while in the third instance the pressure, on expiration, rose to zero. The extent of the fluctuation now likewise increased. In other words, more work was done in order to fill and empty the lungs with air. The tidal air must, if anything, have been diminished and such an increase in the pleural pressure fluctuation can mean only an increased pulmonary congestion comparable to what has been described in congestive heart failure.<sup>12</sup>

DISCUSSION.—One of the most obvious results of thoracoplasty in the early stages after operation is the extreme reduction in the total lung capacity and the functional residual air that appears altogether out of proportion to the extent of the rib resection. Even permitting of a small area of fibrotic disease in the contralateral lung, the impairment of lung capacity is greater than in those individuals that have only one functioning lung.

TABLE II

*The lung volume and its subdivisions, etc., in a case of left-sided chronic pneumothorax, a case of complete bronchial stenosis of the left bronchus, and a case of total pneumonectomy of the left lung for carcinoma*

	Y. M. Pneumothorax	A. M. Bronchial Occlusion	J. G. Pneumectomy
Total Capacity.....	1828	4122	2798
Functional Residual Air.....	984	2680	1725
Residual Air.....	898	2032	1364
Ratio $\frac{FRA}{TC}$ .....	53.9	65.0	61.6
Respiration Rate.....	26.8	11.6	10.3
Tidal Air.....	148	504	430
Coefficient of Ventilation.....	5.5	4.74	4.86
Alveolar pCO <sub>2</sub> .....	42.0	39.0	44.0
Oxygen Saturation of Arterial Blood		90.3	94.8

Thoracoplasty frequently reduces the functional capacity of the lungs below that of an extreme collapse of each lung in bilateral pneumothorax. In case W.T., where the residual air and the functional residual air are reduced to 650 cc. and 750 cc. respectively, yet the ratio of the functional residual air to the total capacity is 40.7, a figure that lies within the range of the normal variation.

It has recently been ingeniously demonstrated by Bjorkman<sup>13</sup> that not only is there remarkably little function in the diseased lung before operation, but also, after collapse, there is less. This he did by catheterizing each lung separately through a bronchoscope. His graphic tracings show conclusively the non-existence of pendulum air since there is no absolute paradoxical breathing.

At least some of the main reasons for a reduction of the lung capacity are to be found in the collapse of the chest wall, the paralysis of the diaphragm, weakness of the respiratory muscles and, in the early stages after operation, pain and paradoxical breathing. Yet with even these factors one would

not expect to see the total capacity of the lungs reduced by 50 per cent. Obviously there must be some other mechanism, such as pain, reflex inhibition of breathing or pulmonary congestion. The functional residual air would not, however, be diminished by pain or any other reflex action as would the total capacity.

It is not unnatural to find those factors that are vital to life remaining close to the normal limits, such as an adequate oxygen saturation of the arterial blood, a normal pressure of  $\text{CO}_2$  in the blood and alveolar air and a normal coefficient of ventilation. The respiratory reserve, on the other hand, is greatly reduced and, in the case of L.L., practically eliminated. In this instance, the complementary air only differed from the tidal air by a few cubic centimeters, while the oxygen saturation of the arterial blood was 69 per cent. Bearing these factors in mind, the high mortality rate in the early stages of thoracoplasty, where 9, 10, and 11 ribs were removed at one operation, is not in the least surprising. Such a picture, too, should be seen by the mind's eye of the surgeon as he performs an extensive thoracoplasty.

A vast amount of experimental work has been done in pneumothorax to explain the circulatory readjustments. The oxygen saturation in the average pneumothorax case remains within normal limits; while in those patients upon whom arterial punctures were done after operation there was found quite a considerable reduction. This can be accounted for either by a diminution of aeration of the blood in the healthy lung, in the diseased lung, or both. The fact that the pulmonary circulation rate is at least temporarily decreased after thoracoplasty, added to the fact that the distensibility of the contralateral lung is diminished, are strong points of evidence in making clear the presence of a passive congestion in the uncollapsed lung.<sup>12</sup> The increased density of the radiographic shadow, the high normal or elevated venous pressure, and the occasional hemoptyses that possibly simulate those found in mitral stenosis, constitute additional evidence that points to the same conclusion. One would likewise expect an increase in the pulmonary second sound, a right heart hypertrophy and electrocardiographic changes, but of these factors we have not made a detailed study.

Unfortunately, we have little proof from this amount of data to show that the lung can, with time, regain a portion of the reserve it has lost. There is, however, an immense amount of clinical evidence to confirm these points.

We believe that the alteration in the respiratory rate and volume and dyspnea result from the decreased distensibility of the lung through the Hering-Brauer reflex, but it is not within the scope of this presentation to defend such a statement.

#### SUMMARY

In this study there have been measured the various subdivisions of the lung volume—the total capacity, the functional residual air and the residual air—before and after thoracoplasty. Within a short period of the opera-

tion, these values tend to become greatly reduced, and their absolute measure in any given case must serve as a guide to the surgeon when contemplating further collapse. The ratio of the functional residual air to the total capacity in this connection is emphasized. The reductions in total capacity and functional residual air are greater in most cases than can be attributed to the operation alone. This can be explained largely by the change in the pulmonary circulation which, for a time, shows a lessened velocity. The distensibility of the uncollapsed lung is diminished, the intrapleural pressure being altered to simulate that found in circulatory failure.

The increased density in the radiogram of the contralateral lung, the high normal or elevated venous pressure, the diminished oxygen saturation of the arterial blood and the occasional hemoptyses that follow operation, all seem to indicate that the reduction in lung capacity after operative collapse is due largely to a passive venous congestion.

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DISCUSSION.—DR. EDWARD D. CHURCHILL (Boston, Mass.).—Doctor McIntosh has presented an exacting and quantitative study concerning certain functions of the lung. I am sorry that his manuscript was not available for study before his presentation as it is impossible to make any intelligent comment on the data without more deliberate consideration.

The general significance of such studies is quite apparent, however. Advances in thoracic surgery have now made possible the successful removal

of one entire lung. More exact determination of function is now essential as in other situations where a surgeon takes the responsibility of removing one member of a paired organ.

Determinations of vital capacity are very limited in their value. Determination of the actual volume of the lungs is a step in advance, as also is the study of residual air in relation to total lung volume. What is greatly desired at the moment is a simple method of determining what may be called the "split" function of the lung or the assessment of the separate functions of the right and left lungs, respectively.

As the rôle of surgery in pulmonary tuberculosis has been extended to include frankly bilateral cases, it becomes important to gain a clear concept of the ability of a partially diseased lung to meet the needs of the body. In the application of total pneumonectomy to malignant disease we are faced with an age group of patients that are notoriously poor risks for radical thoracic operations. Many have emphysema or other cardiorespiratory changes associated with advancing age, and it seems imperative to test the function of the lung that is to remain before removing the one that contains the cancer.

The best method available at the moment is to collapse the lung that is to be removed by artificial pneumothorax, but this is not always possible. Even a total pneumothorax on one side does not reproduce the state of affairs that follows the surgical extirpation of one lung.

Efforts are being made in the clinic of Professor Jacobeus in Stockholm to determine the function of each lung separately by means of a cannula inserted directly into one primary bronchus. This method combined with the careful methods of study used by Dr. McIntosh may point the way to the desired goal.

## SURGERY FOR CERVICAL RIBS \*

RUSSEL H. PATTERSON, M.D.

NEW YORK

### CASE REPORTS

CASE I.—Miss U. W., 24 years of age, a typist, referred by Dr. P. E. Sabatelle, June 15, 1934.

*Present Illness.*—As a child she had had occasional pain in her left arm and, for many years, occasional cramps in her left hand which had grown weak during the past two years. Two months before examination these symptoms increased, with the addition of pain around the left wrist and left thumb and on the left side of her neck, sometimes radiating down the left side of her body. At times there seemed to be some numbness in the left thumb on the palmar aspect. She stopped her work as a typist for a few weeks and the pain in her left arm disappeared, but not the pain in her neck. As soon as she resumed typing, the pain in her left hand recurred.

*Physical Examination.*—The patient was a very small woman, weighing 97½ pounds, healthy in appearance and well nourished. In the posterior triangle of the left side of the neck at about the middle of and above the clavicle there was a definite bony prominence and general fulness which was not present on the right side of the neck. Pressure over this area was painful, locally. There was no disturbance in sensation of the entire left upper extremity. The grip in the left hand was noticeably weak and there was a moderate amount of atrophy of the thenar eminence of the left hand. Roentgen examination showed cervical ribs on both sides articulating with the first ribs (Fig. 1).

*Operation.*—June 20, 1934, at the Hospital for Ruptured and Crippled, the patient was operated upon under gas-oxygen anesthesia. An oblique incision was made in the left side of the neck, one and one-half inches lateral to the attachment of the sternocleidomastoid muscle just above the clavicle, as suggested by Dr. Alfred S. Taylor. The fascia over the brachial plexus was exposed and divided. The brachial plexus, the scalene muscles and the subclavian artery were exposed. The brachial plexus was found pinched between the cervical rib and the middle scalenus muscle on one side and the anterior scalenus muscle on the other side. The cervical rib was partly covered by the scalenus medius muscle. There was a definite articular facet on the first rib for the end of the cervical rib. The scalenus medius muscle was divided at the junction of its middle and lower thirds. The cut end of the lower third was clamped and pulled forward against the brachial plexus. This served as an excellent retractor for the plexus. The entire cervical rib was removed with rongeurs. The transverse process of the seventh cervical vertebra was not disturbed. The brachial plexus and subclavian artery then fell back into the space occupied by the cervical rib. The anterior scalenus muscle was then divided and the wound closed.

July 3, 1934, 13 days after operation, the patient had no symptoms in her left hand but there was a slight anesthesia over the left shoulder. July 27, 1934, the blood pressure in the left arm was 116/65, in the right arm 109/65. There were no changes in the blood pressure before operation. There was diminution of skin sensation over the shoulder lateral to the scar of operation. October 15, 1934, the patient was symptomatically relieved, having no complaints whatever. Her grip was good and the extremity appeared normal.

CASE II.—Miss M. D., age 22, a dictaphone operator, referred by Dr. H. H. Fel-

\* Presented before the New York Surgical Society, February 27, 1935.



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lows, examined October 27, 1932. Except for tonsillectomy one year ago her past history is negative.

*Present Illness.*—Although the patient thought her left arm had "always been funny," symptoms in this extremity were not especially noticeable until two years previously when she began to experience pain in the front part of the left shoulder and left side of the neck, the pain jumping to the back of the left forearm. She had no pain whatever in the left upper arm, but whenever she slept on her left shoulder she would awaken from the pain. This would disappear when she turned over. More recently, the attacks of pain were associated with sore throat. The grip in her left hand she

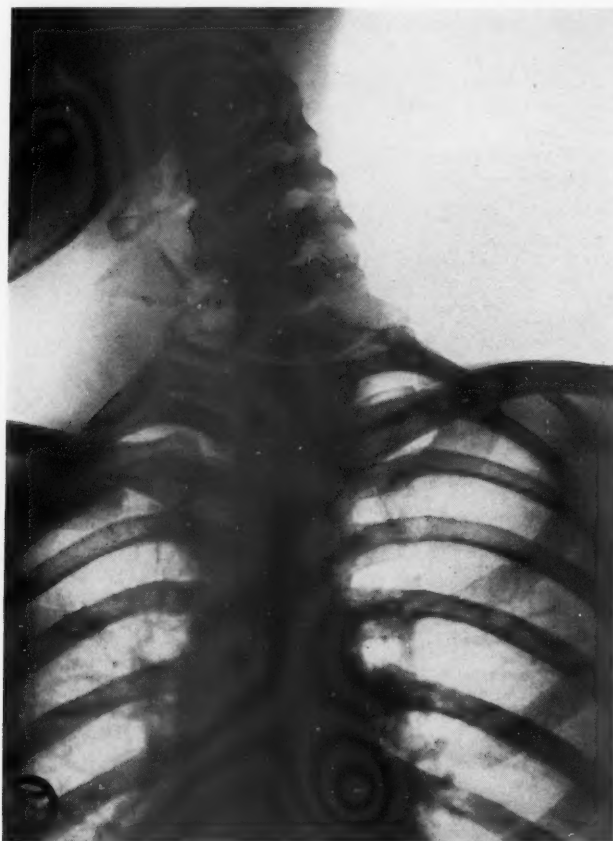


FIG. 1.—Preoperative roentgenogram of Case I. The cervical rib is shown as a direct shadow running from the seventh cervical transverse process down to and articulating with the rib just above the shadow of the clavicle.

thought was not impaired but she would experience a tingling of the third, fourth and fifth fingers of the left hand and at times the outer three fingers grew numb as she typed.

*Physical Examination.*—The patient is a healthy appearing girl, weighing 116 pounds, with round shoulders and normal reflexes. There was a fulness on both sides of the base of the neck, but particularly on the left, extending over an area several inches in diameter and lying roughly above the outer end of the left clavicle and in front of the anterior border of the trapezius muscle. The swollen area was firm and painful on deep palpation. There was no atrophy of the left upper extremity and no disturbance of skin sensation. Both pulses were equal. Roentgen examination showed a cervical

rib on the left side articulating with the first rib. There was also a rudimentary cervical rib on the right side (Fig. 2).

*Operation.*—November 15, 1932, at the Hospital for Ruptured and Crippled, under gas-oxygen anesthesia an incision was made similar to the one described in Case I. The cervical rib articulated with the first rib at the attachment of the middle scalenus muscle. The lower third of the middle scalenus muscle was divided and the distal end grasped with a clamp and used as a retractor for the brachial plexus. The rib was then removed with a rongeur and afterwards the brachial plexus and subclavian artery dropped back into the place formerly occupied by the rib. Attempt to remove

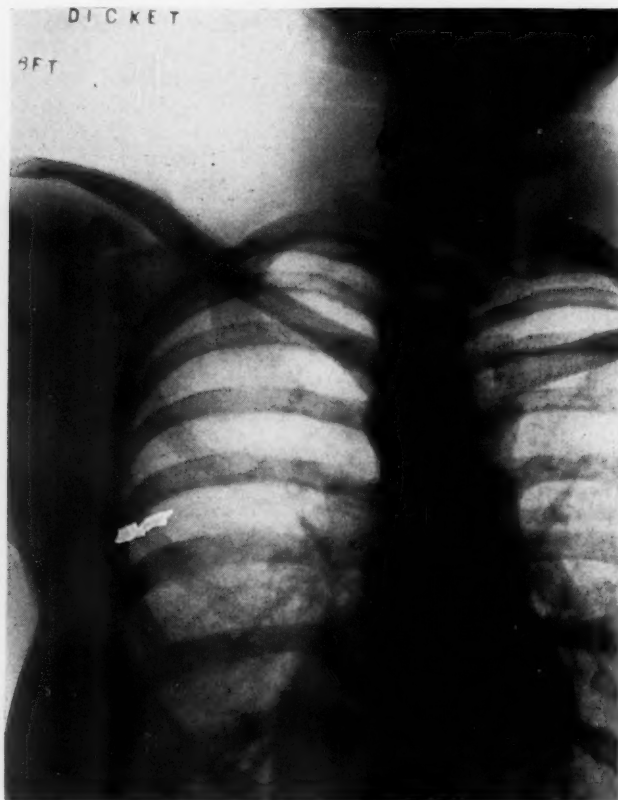


FIG. 2.—Preoperative roentgenogram, showing cervical rib in Case II as a direct shadow running from the seventh cervical transverse process down to and articulating with the rib just above the shadow of the clavicle.

the rib in one piece is dangerous. The anterior scalenus was then divided at its attachment with the first rib so that there could be no question of pressure on the brachial plexus.

*Follow Up.*—For several weeks, the patient had some pain in the region of the ulnar nerve distribution, due probably to too much retraction on, and handling of, the brachial plexus. Extreme gentleness is necessary in this operation. The skin over the left side of the neck was very hypersensitive. There was no atrophy in the left hand or left arm and no limitation of motion in any joint. She claimed to feel a "pulling sometimes in the left side of the neck." April 28, 1933, the patient had returned to her usual work and was free of all symptoms.

## SURGERY FOR CERVICAL RIBS

CASE III.—Mrs. A. M., 28 years of age, housewife, referred April 16, 1935, by Dr. J. Sullivan and Dr. H. C. W. S. deBrun.

*Present Illness.*—About six months ago patient began to have marked pain and numbness in her left upper extremity. A week or two later she noticed lumps on the left side of her neck, the inner side of her left upper arm, the inside of the left elbow and the left wrist. The left hand has become thin, weak and is always as cold as ice. Numbness of the whole extremity bothers her the most. She has peculiar tingling pain in the index, middle and ring fingers.

*Physical Examination.*—Chubby, small, overweight Irish woman. There was slight swelling at the base of the left side of the neck. The upper arms were each  $10\frac{3}{4}$  inches in circumference. The left wrist was one-quarter of an inch smaller than the right which measured  $6\frac{1}{4}$  inches. The left hand is a little thinner than the right. There may be slight atrophy of the intrinsic muscles of the left hand but particularly of the thenar and hypothenar eminences. The pulse in the left wrist cannot be felt. Axillary

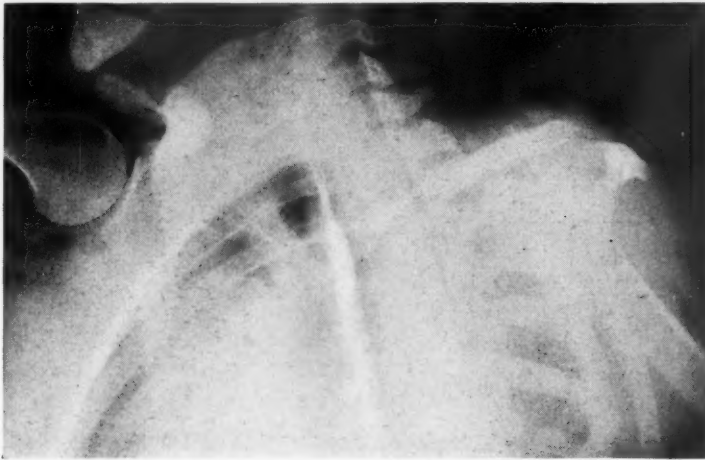


FIG. 3.—Roentgenogram of Case III. Showing cervical rib from a lateral view of the chest. The rib may be seen at the top of barium which was just passing through the esophagus.

pulse on the right can be felt but not on the left. Blood pressure right arm 120/80. Left—no blood pressure can be obtained. She has diminished tactile sensation on the dorsum of the third and fourth fingers of the left hand. The skin of the palm and dorsum of the hand is hypersensitive. When she stands up there is distinct fulness in the left side of the neck. Pressure over this fulness causes her local pain. Twisting her head to the left is painful. Roentgen examination showed cervical ribs on both sides articulating with the first ribs (Fig. 3). The lateral views of the cervical region were particularly interesting in that they showed the full length of the cervical rib in a view not commonly seen.

*Operation.*—April 17, 1935, at the Hospital for Ruptured and Crippled the patient was operated upon under gas-oxygen anesthesia. An oblique incision was made in the left side of the neck similar to Cases I and II. The anterior scalenus muscle was identified and found to be  $1\frac{1}{2}$  inches or more in diameter, being greatly hypertrophied. The cervical rib was deep and articulated with a definite facet at a point on the first rib corresponding to the interval between the scalenus medius and scalenus anticus muscles. The brachial plexus was very deep and was a so called postfixed type (Fig. 4). In other words, it came off one segment lower than normal. The subclavian artery came up distinctly over the cervical rib very near the articular facet on the first rib.

The artery was angulated. It consisted of a thick fibrous cord the size of an ordinary pencil. Its walls could not be compressed. There was no blood in it as was shown by the fact that a hypodermic needle was introduced at intervals and no blood obtained. It would have been interesting to inspect the artery for a greater part of its course, but this was not practical because serious interference with collateral circulation might have resulted. The anterior scalenus muscle was completely divided near its rib attachment. The scalenus medius muscle was divided. The cervical rib was removed from its attachment to the first rib back to within  $\frac{1}{2}$  inch of the pedicle and the wound then closed.

May 15, 1935, four weeks following operation, the patient noted that the increased warmth in the left upper extremity, which had been noted immediately after the operation, still persisted. The extremity did not feel so numb and there was none of the old pain that the patient had previously felt. However, there were times, particularly at night, that a different type of pain was experienced through the shoulder and ex-

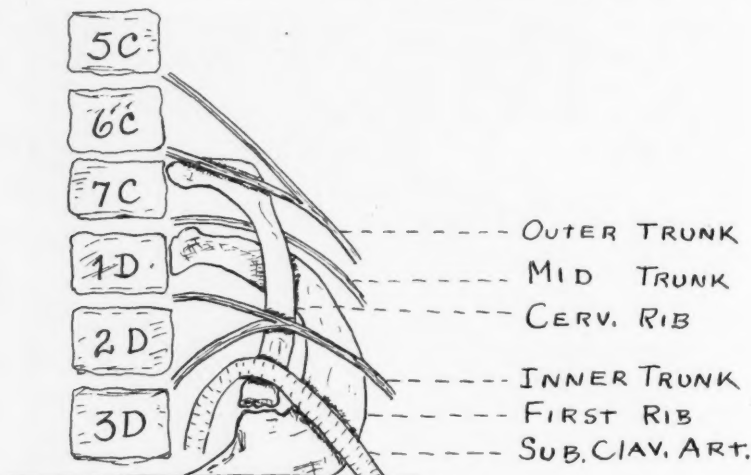


FIG. 4.—Diagram of Case III, illustrating the postfixed brachial plexus and its relation to the cervical rib. Also the relationship of the subclavian artery to the cervical rib.

trinity. This was interpreted as being due to the handling of the brachial plexus at operation. Postoperative roentgenograms showed the left cervical rib to have been removed.

#### COMMENT

(1) Cervical ribs giving symptoms are not common in the average surgical practice.

(2) The use of the distal end of the divided scalenus medius muscle as a retractor for the brachial plexus is a helpful maneuver in the removal of a cervical rib.

(3) Reviewing the anatomy of the neck, Piersol makes the following points: There may be a slight outward projection from the ventral side of the cervical vertebral body representing the prominence for the head of the rib to rest upon; there may be a hooklike growth of bone from the tip of the transverse process; a cervical rib may develop from a separate center of ossification anterior to these two bony variations; and these may all grow

in such a manner as to form a transverse foramen and a cervical rib. The cervical rib may run forward parallel to the first rib sometimes reaching half way to the sternum and sometimes articulating with the first rib. Occasionally a process grows up from the first rib to meet the cervical rib. This process may raise or markedly encroach upon the subclavian artery.

Furthermore, there may be a variation in the scalene muscles. Their origins may be increased or diminished; fusion may occur; the scalenus anticus may be perforated by the subclavian artery and the portion of the muscle so separated may form a distinct muscle, the scalenus minimus. This muscle may attach itself to the upper surface of the first rib and to the dome of the pleura.

A great many of the fibrous bands, described by various surgeons as encroaching upon the brachial plexus, would be better understood were all these anatomic variations appreciated. Because of these variations I do not believe we can set down a single procedure which, when carried out, will relieve every case of so called cervical rib. Simple division of the scalenus anticus has been advocated by some as being the operation of choice for all so called surgical ribs. I believe we must deal with variations as we find them at the time of the operation. Furthermore, symptoms will vary according to the variations in the anatomy.

(4) I have seen three other cases of well marked cervical ribs in the last year. None gave symptoms. One case was in a nurse, one in a patient with a severe pulmonary infection, and one in a girl with an adenoma of the thyroid.

(5) Most of these cases are in working girls who do not have symptoms until over 20 years of age.

(6) Why the symptoms nearly always occur on the left side, even though the cervical ribs are bilateral, I do not believe is known.

(7) Case III seems to be quite unusual, a report of Cushing's being the only other instance in which an obliteration of the artery has been described.

(8) Roentgenograms taken in the lateral position, as shown in Fig. 3, are very instructive and have in the past not been routinely taken.

DISCUSSION: DR. DE WITT STETTEN (New York) said that cervical rib cases might be divided into two classes, those producing nerve symptoms and those producing arterial symptoms. Although the vascular cases constitute the minority, they are very interesting, as illustrated by a case recently treated. The patient was a telephone operator with a cervical rib, not on the left, but on the right side. The symptoms were entirely vascular, a typical Raynaud's syndrome developing in the hand, especially when it became cold. Under ordinary conditions there was not much difference in the pulse, but if the arm were pulled on the long axis of the body and the head turned sharply to the opposite side, stretching the scalenus muscle, the pulse could be obliterated (Halsted test). At operation, as the scalenus anticus was divided, the artery—which was acutely kinked by the tense muscle—completely relaxed and straightened out. In spite of this, and the fact that division of the scalenus anticus would probably have been sufficient, Doctor



Stetten resected the larger portion of the cervical rib which articulated with the first rib.

Particular attention should be called to a possible difficulty not mentioned by Doctor Patterson, that is, the ease with which the pleura may be punctured during resection of a cervical rib. In the case cited above this accident occurred even though the possibility was borne in mind and the greatest precautions taken to prevent it. Opening of the pleura rarely occurs in upper thoracoplasties, but, of course, this operation is usually done in tuberculous cases with a thickened pleura, and often with obliterated pleural cavities, so that the danger is very slight. In cervical rib cases, however, there appears to be a long tongue of extremely thin pleura that comes right up to the periosteum of the rib. In this instance the periosteum had been completely separated from the rib and he was about to resect the rib with a costotome when the tip of the instrument, which was not quite adapted for his particular purpose, made a small hole in the pleura. Suture was attempted but, owing to the thinness of the tissue, was found to be impracticable. Influx was controlled readily by a tamponade. There was no unfavorable result except the necessity for drainage and a slight postoperative rise of temperature with an insignificant pleural exudate which was absorbed. The patient's symptoms were completely relieved by the operation and the Halsted test became negative.

DR. IRA COHEN (New York) drew attention to the fact that in connection with vascular symptoms, in addition to actual pressure there is an element of spasm, well illustrated in the case of a nurse with a cervical rib whom he treated in 1933. In this patient, without any change of posture, the radial pulse would disappear, only shortly afterwards to reappear and then disappear again. The appearance of the hand resembled that of Raynaud's disease. Division of the scalenus muscle alone relieved the symptoms.

DR. JOHN M. HANFORD (New York) described the case of a colored woman, aged 28, at present in Presbyterian Hospital, with a cervical rib on the right side instead of on the left where it usually occurs. The patient came in because of weakness, dyspnea, palpitation, and pain in the right upper limb. In the Medical Ward, she was found to be running a low grade fever, the cause of which had not been determined. Her basal metabolism and Wassermann tests were negative, the blood pressure normal. On examination, there was an enlarged heart, rapid pulse and dilatation of the subclavian artery just beyond the rib, which may be indirectly the causation of the circulatory findings. The rib is evidently constricting the artery which is dilated beyond the constriction, measuring 2 cm. at least, and is much larger than that on the left side. It gives a bruit and a definitely pulsating expansion is visible and easily palpable.

Apparently the local symptoms in this case are due more to pressure on the subclavian artery than on the nerve plexus. The patient does not appear to have symptoms corresponding to pressure on the ulnar nerve or on the median cord of the plexus. She does have some weakness of the hand and some paresthesia of the upper limb. The constriction of the artery by the cervical rib may be causing a terrific impact on the wall of the artery just beyond, gradually weakening it over a period of years. Another theory is that nutrition of the artery just beyond the constriction is such as to weaken it. Actually, the patient now presents the picture of a small aneurysm which may easily interfere with the operation which the patient certainly should have to release the pressure.

## SURGERY FOR CERVICAL RIBS

DR. BYRON STOOKEY (New York) felt that it would be futile to attempt to classify cervical ribs into groups in view of the wide variations. There may be a cervical rib varying from a very small nubbin to a complete bony rib, which articulates behind with the vertebra and in front with the first rib, or, in place of articulating, fuses with the vertebra, with the first rib, or with both, thus presenting a solid bony structure. Important to remember, too, is the fact that instead of a bony rib, a small fibrous band may continue forward from a very small transverse process to the first rib in front and compress the plexus as though it were a solid rib. Although this fibrous band does not show in the roentgenogram, it may nevertheless give rise to the same symptoms as an actual bony protuberance.

Cervical ribs appear most commonly in the presence of a prefixed plexus, that is, a plexus which has arisen a segment or two higher than is considered normal, the normal—if normal there be—being really a mean between a prefixed and a postfixed plexus. The variation in the position of the plexus depends upon the position of the developing limb bud. It is the relative position of the plexus to the developing cervical costal structures which determines whether or not a cervical rib will form, since the outgrowing nerve bundles cut off the mesodermal costal structure which would normally develop a cervical rib were it not for the traction of the outgrowing nerve bundles across the developing costal structures. In the lower forms where extremities do not exist and hence no limb bud or outgrowing nerve bundles, cervical and lumbar ribs are the rule. The only reason cervical and lumbar ribs are not present is due to the developing limb bud and the nerve structures which grow out to reach the limb bud.

Among the reasons given for the development of symptoms in the second, third and often as late as the fourth decade is the fact that ossification in later life destroys the resilience which is found in younger individuals. Moreover, in adult life there is a further descent of the shoulder which puts greater stress on the plexus itself as it passes over a cervical rib. However, in Doctor Stookey's opinion, the most likely explanation is the same mechanism which produces ulnar nerve palsies 20 or 30 years after fracture of the internal condyle of the humerus. Under these circumstances the ulnar nerve is subjected to continuous trauma with each extension and flexion of the forearm due to the faulty angle of the internal condyle which makes the ulnar nerve cross the condyle at an acute angle. Similarly, by each inspiration and expiration the rise and fall of the thorax causes pressure upon the brachial plexus as it passes out of the thorax over a cervical rib. This continuous trauma eventually injures the nerves just as the sharp angle of a fractured internal condyle of the humerus injures the ulnar nerve, and symptoms occur.

Doctor Patterson's point of using the scalenus muscle as a retractor to pull the brachial plexus forward Doctor Stookey regarded as excellent, since trauma to the plexus is very likely to occur unless great care is used to avoid traction upon the nerve roots.

## POSTERIOR DRAINAGE IN SUPPURATIVE PERICARDITIS

RICHMOND L. MOORE, M.D.

NEW YORK

FROM THE DEPARTMENT OF SURGERY OF THE PRESBYTERIAN HOSPITAL AND OF THE COLLEGE OF PHYSICIANS AND SURGEONS, COLUMBIA UNIVERSITY, NEW YORK CITY

CASES of acute suppurative pericarditis are not common and the diagnosis and treatment of this condition have always been of great interest to both physicians and surgeons. The opportunity was recently afforded to care for a patient who presented the typical signs of increased intrapericardial pressure and who recovered in due time after the institution of drainage and repeated irrigations of the pericardial cavity. In this instance, at the suggestion of Dr. Hugh Auchincloss, the pericardial sac was opened posterolaterally in its dependent part and it was the impression of those who followed the course of the patient after operation that recovery was due in large measure to the satisfactory drainage which was provided by this incision. When this patient came under my care I was not familiar with the paper which was recently published by Truesdale<sup>1</sup> in which he advocated drainage through an incision similar to the one which I used. He apparently also appreciated the difficulty of maintaining adequate drainage through the anterior (parasternal) route, and when the situation became desperate in his case, decided to supplement the anterior incision with a posterior one, accepting the risk of opening and infecting the pleural space for the advantages of dependent drainage. He found the base of the left lung adherent to the pericardium and was able to strip it away and expose the posterolateral wall of the pericardium without entering a free pleural cavity. The presence of adhesions minimized the possibility of a complicating empyema, but regardless of what the outcome would have been if the latter complication had arisen, the patient made a satisfactory recovery.

Adhesions were present in my case also, making it similar to that reported by Truesdale. Drainage of the pericardium posteriorly was felt to be so important that the decision was made to enter the pleura (if need be) in order to accomplish it, and accept the risk of a pneumothorax and another empyema. Fortunately, the adhesions made it possible to expose the posterolateral wall of the pericardium without this complication occurring.

### CASE REPORT

*History and Physical Examination.*—A Jewish boy, aged 12, was referred by Dr. M. R. Bradner of Warwick, N. Y., June 3, 1934. His illness dated from the latter part of February, when he developed a pneumonia of the left lung. Temperature remained elevated for seven days and then dropped rather abruptly to slightly above normal. After this his convalescence was complicated, first by marked distention of the abdomen, which persisted for one week; then by an abscess of the left middle ear, which necessitated drainage; and finally by a suppurative pleurisy on the left side

## DRAINAGE IN PERICARDITIS

posteriorly. The organism was not determined. The left pleural cavity was drained on April 2 by resecting a segment of the eighth rib, following which the patient improved. At the end of the second week he was up and walking when suddenly his temperature rose to 105°. The fever persisted, running an irregular course, and on May 7 a piece of the ninth rib was resected in order to provide more adequate drainage for the empyema cavity. The boy's condition was never satisfactory after this. The wound continued to drain, temperature remained elevated and there were repeated spells of nausea. May 22 the wound was explored with a small rubber catheter and radiographs of the chest were made after the injection of lipiodol. These demonstrated a sinus tract which extended through the chest wall for a distance of about 2½ inches, but no cavity. The sinus tract was irrigated frequently with Dakin's solution during the next three days and the boy seemed to improve again. Then his temperature became very high and another radiograph of the chest showed a distended pericardium. The pericardial sac was aspirated through the fourth intercostal space and 60 cc. of thin, turbid fluid were recovered. Smear and culture were not made. The boy did not show any tendency to improve and on June 3 he was transferred to the Presbyterian Hospital.

The following observations were made during the three days preceding operation: The boy was pale and weak, but in a surprisingly good state of nutrition considering the duration and nature of his illness (Fig. 1). There was no cyanosis and no edema. Respirations were rapid and shallow with expiratory grunt and pronounced retraction of the lower intercostal spaces anteriorly on both sides. Temperature fluctuated between 100.8° and 104.6°. The veins in the neck were distended, but not greatly dilated and not tortuous. The superficial veins over the anterior chest wall, abdomen and upper extremities were plainly visible and dilated, but could not be felt. The right chest was clear. The left chest showed dullness and diminished breath sounds posteriorly in the region of the operative scar. A cardiac impulse could neither be seen nor felt. The left border of cardiac dullness was 4 cm. to the left of the midsternal line in the first interspace, 5.5 cm. to the left in the second, 10 cm. in the third and 11 cm. to the left in the fourth and fifth. The right border of cardiac dullness also was 4 cm. from the midsternal line in the first interspace, 5.5 cm. in the second, 6.5 cm. in the third and fourth, and 6 cm. in the fifth. Heart sounds were faint. The measurements of the heart as obtained from a two meter heart film were reported as follows: MR 6.7; ML 9.0; TD 15.7 and GV 7.8; internal diameter of the chest 22.5. The area of cardiopericardial density was described as having a "water-bottle" shape (Fig. 2).

A fluoroscopic examination did not reveal any cardiac pulsations on either side. An electrocardiogram showed elevation of the RT interval in the first and second leads and inversion of the T waves in the first lead. There was a marked pulsus paradoxus, and the pulse, which varied between 110 and 140, could not be accurately obtained at the wrist. The arterial pressure was not recorded. The venous pressure, as obtained by the direct method of Moritz and von Tabora<sup>2</sup> was 240 cm. of physiologic salt solution. The abdomen was prominent and gave a fluid wave. The liver was enlarged and tender, its edge palpable 8 cm. below the costal margin in the midsternal and midclavicular lines. Red blood cells were 3,800,000; hemoglobin, 53 per cent; white blood cells, 14,400; polymorphonuclear leukocytes, 85 per cent. The urine was negative except for a faint trace of albumin.

June 4 the pericardial sac was aspirated again through the fourth intercostal space. The needle was introduced 1 cm. within the line of the nipple and 90 cc. of thin, light green, turbid fluid were withdrawn. When this amount had been obtained the aspiration was discontinued because the fluid became blood tinged and the pulsations of the heart were being transmitted to the shaft of the needle. The venous pressure was measured repeatedly while the fluid was being withdrawn. After the withdrawal of 6 cc. it was 210 cm. of physiologic salt solution. When 20 cc. had been withdrawn



FIG. 1.—Photograph of patient taken June 5, the day of operation. The crosses mark the sites of the two aspirations.



FIG. 2.—Roentgenogram taken June 4. 90 cc. of light green turbid fluid were withdrawn from the pericardium shortly after this film was made and at operation on the following day an additional 500 cc. were obtained. The empyema cavity was closed at this time, but a drainage tube was still present in the sinus tract that remained. This tube can be seen very distinctly in the picture.



## DRAINAGE IN PERICARDITIS

it had dropped to 165 and subsequently the measurements were 155, 145, 135, 125, and 115; after the withdrawal of 40, 60, 70, 80 and 90 cc., respectively. A culture of the fluid showed hemolytic streptococci. Specific gravity was 1.020 and the cell count was 19,000.

*Operation.*—Operation was performed under colonic ether anesthesia June 5. The left lung was adherent to the chest wall, diaphragm and pericardium, permitting the pericardium to be exposed without opening the free pleural space. The adhesions were delicate and were easily separated without bleeding of any consequence. The exposed surface of the pericardium bulged into the wound. When it was opened the exudate within spurted through the incision. The amount of exudate was not measured, but it was estimated to be at least 500 cc. The exudate was turbid, thin, light green, and contained clumps of fibrin. The surface of the heart was covered with a shaggy fibrinous exudate. After the heart was decompressed the boy breathed more easily and the volume of the pulse improved.

*Operative Procedure.*—Patient in a reclining position, turned slightly to the right side so as to permit access to the left axilla. A double curved incision was made over the fifth intercostal space, extending from the lateral end of the sixth costal cartilage to the posterior fold of the axilla (Fig. 3). The two flaps thus made were reflected upward and downward to expose the surfaces of the fifth and sixth ribs. Access to the thorax was gained by resecting subperiosteally segments of the anterior ends of the fifth and sixth ribs, each approximately four inches in length. In front the ribs were divided just lateral to the costochondral junctions. The intercostal muscles, together with the intercostal fascia, were stripped away from the parietal pleura and the vessels ligated both anteriorly and posteriorly. The pleura was incised through the bed of the sixth rib and the adherent part of the lung dissected off the diaphragm and pericardium. This gave an excellent exposure of the pericardium posterolaterally. The pericardium was opened through a horizontal incision approximately three inches long, the exudate evacuated and pressure-maintenance drainage established with a specially constructed tube (Fig. 4).<sup>\*</sup> The tube was anchored snugly in place with vaseline gauze, supported with additional dressings of dry gauze and fixed to the chest with strips of broad adhesive. The boy left the operating room in good condition. However, there was a slight suggestion of cyanosis and for this reason the administration of oxygen in a tent was begun immediately.



FIG. 3.—Diagrammatic sketch showing the position of the incision that was made in the case reported. The shaded parts of the fifth and sixth ribs were resected.

<sup>\*</sup> It is not felt that the use of closed drainage in this particular case was essential, because the free pleura was not opened. The author believes that open drainage would have been equally as effective. The use of two large rubber tubes would have provided more adequate drainage and in another similar case it is planned to use two tubes, passing them through the apex of a silk and gauze tampon down to, but not through the opening in the pericardium. The tampon would serve to hold back the edges of the wound and the lung, causing them to be molded apart. In this manner, after six or seven days a spacious tract would be established and the tubes and tampon could be discarded.

In consideration of the experiments of Beck and Isaac<sup>3</sup> there is reason to believe

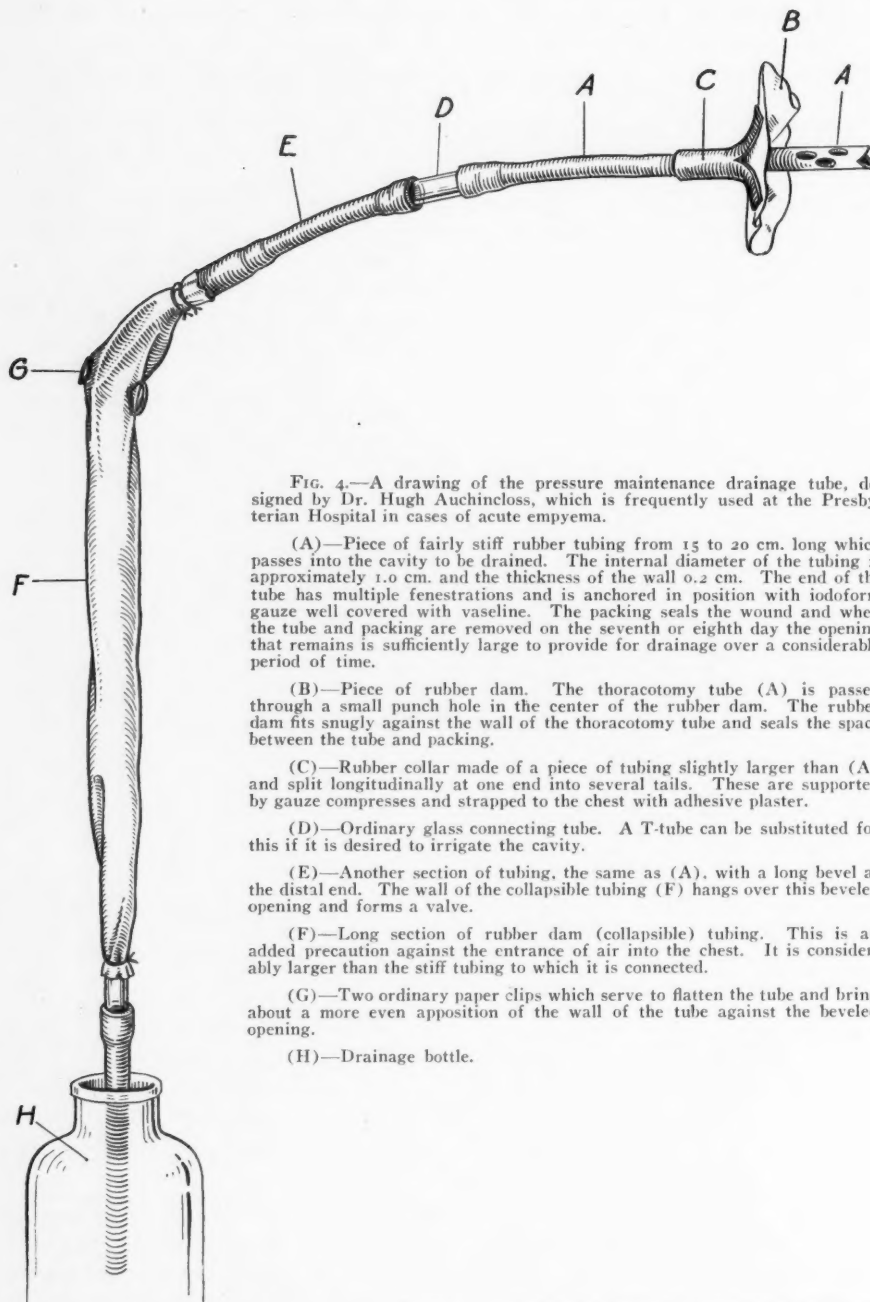


FIG. 4.—A drawing of the pressure maintenance drainage tube, designed by Dr. Hugh Auchincloss, which is frequently used at the Presbyterian Hospital in cases of acute empyema.

(A)—Piece of fairly stiff rubber tubing from 15 to 20 cm. long which passes into the cavity to be drained. The internal diameter of the tubing is approximately 1.0 cm. and the thickness of the wall 0.2 cm. The end of the tube has multiple fenestrations and is anchored in position with iodoform gauze well covered with vaseline. The packing seals the wound and when the tube and packing are removed on the seventh or eighth day the opening that remains is sufficiently large to provide for drainage over a considerable period of time.

(B)—Piece of rubber dam. The thoracotomy tube (A) is passed through a small punch hole in the center of the rubber dam. The rubber dam fits snugly against the wall of the thoracotomy tube and seals the space between the tube and packing.

(C)—Rubber collar made of a piece of tubing slightly larger than (A) and split longitudinally at one end into several tails. These are supported by gauze compresses and strapped to the chest with adhesive plaster.

(D)—Ordinary glass connecting tube. A T-tube can be substituted for this if it is desired to irrigate the cavity.

(E)—Another section of tubing, the same as (A), with a long bevel at the distal end. The wall of the collapsible tubing (F) hangs over this beveled opening and forms a valve.

(F)—Long section of rubber dam (collapsible) tubing. This is an added precaution against the entrance of air into the chest. It is considerably larger than the stiff tubing to which it is connected.

(G)—Two ordinary paper clips which serve to flatten the tube and bring about a more even apposition of the wall of the tube against the beveled opening.

(H)—Drainage bottle.

that the filling of the heart is supported by subatmospheric pressure. After rib resection, however, it is not practical to maintain an airtight seal for more than six to eight days. Since drainage in suppurative pericarditis must be provided for a much longer period than this, and since irrigations are so important, closed drainage is probably not necessary unless the free pleura is opened and then only long enough to permit the formation of adhesions.

## DRAINAGE IN PERICARDITIS

*Postoperative Course.*—The patient was kept in the oxygen tent until June 20 during which period he continued seriously ill with a high fever ( $102^{\circ}$  to  $104^{\circ}$ ), rapid, weak paradoxical pulse and rapid, irregular and shallow breathing. June 7 the red blood cells were 2,520,000; hemoglobin, 75 per cent; white blood cells, 18,200; polymorphonuclear leukocytes, 71 per cent. Blood culture was negative June 8. A transfusion of 500 cc. of whole blood was given on this date. The immediate reaction to this was alarming. Respirations rose to 60; there was profuse diaphoresis; skin became cold and cyanotic; and pulse almost imperceptible. The boy was listless, unresponsive and had an involuntary defecation. Fortunately he recovered from this reaction within an hour. The drainage tube functioned perfectly and from the time of operation up to the afternoon of June 12, 1,600 cc. of purulent material were evacuated. At this time the dressing had become saturated with pus, and pus was dissecting the adhesive strapping from the skin. Consequently the tube and all the packing were removed and after this the wound was left wide open. The tract which led down to the pericardium was spacious. The heart could be seen through the opening which had been made and a considerable amount of fibrinous exudate was still attached to it. Pus was puddling in the depth of the wound. After irrigating the wound with warm saline, it was dressed with a silk and gauze tampon with a piece of rubber dam passing through the apex of the tampon just to, or perhaps a little way through, the pericardial opening. The wound was irrigated and dressed in a similar manner every day, Dakin's solution being substituted for saline June 15. At first there was no decrease in the amount of discharge, and June 18 a rubber catheter was passed posteriorly to the heart into the oblique sinus (culdesac) and 8 cc. of residual exudate were evacuated. This was repeated with similar results once a day during the next five days and June 23 two Carrel tubes, a long one, through which the cavity was irrigated, and a short one to provide for reflux, were inserted and left in place. After this, instillations of Dakin's fluid were given at frequent intervals until July 9. During this time the wound was dressed daily and at each dressing, after removing the Carrel tubes, the pericardium was irrigated with a pint of Dakin's solution through a catheter.

The purulent discharge cleared up rapidly under this treatment and within a few days the boy began to show definite signs of improvement. Whereas he had been irritable and fretful up to this time, now he became pleasant and cooperative. His appetite increased; the temperature approached a lower level; and the white blood cells which had been 29,000 on June 25, with a polymorphonuclear percentage of 98, had dropped to 16,000 on June 30, with a polymorphonuclear percentage of only 79. July 5, 725 cc. of thin, sterile fluid were aspirated from the right chest. The boy was sitting up for a few minutes each day at this time. He began to walk July 14 and temperature reached normal July 17. Irrigations of the pericardial cavity with physiologic salt solution (which had been resumed July 9 when the instillations of Dakin's solution were discontinued) were stopped July 25. The sinus tract closed July 30 and the boy was discharged from the hospital August 3. At the time of discharge he weighed 80 pounds and was gaining weight rapidly; the veins in his neck were no longer distended; the superficial veins of the trunk and abdomen were much less prominent than they had been; there were no signs of pleural fluid; the liver edge could not be felt; and there was no ascites. The venous pressure June 30 was 88 cm. of physiologic salt solution. The pulse, which had remained rapid and paradoxical until the latter part of July, had slowed to 90 and assumed a normal quality.

*Follow Up Observations.*—The boy continued to improve after discharge from the hospital. He rapidly regained his strength and in two weeks' time gained nine pounds. When seen August 17 he appeared to be in excellent physical condition. The pulse was slow, regular and of good quality. There were no signs of fluid, either in the chest or abdomen. The veins in his neck were not distended and the liver could not

be felt. He was seen again October 8 (approximately four months after operation) at which time he weighed 106 pounds, was active at school and symptom free.

#### DISCUSSION

I do not believe that the recovery in this case is to be attributed solely to the site which was elected for drainage. Such a claim would be open to question because the case was a favorable one in several respects. When the boy came under my care he had recovered completely from his pneumonia, the empyema cavity was closed and the general state of his nutrition was good. Furthermore, after the pericardium was opened, it was irrigated daily, either with saline or Dakin's solution, and drainage was provided without the complicating effects of an open pneumothorax or fresh, pleuritic infection. These advantages, plus the additional fact that residual exudate accumulated posteriorly in the oblique sinus (culdesac), in spite of the posterior incision, make it impossible to evaluate exactly the part which was played by the posterior incision in the recovery of the patient.

On the other hand, the pericardial sac drained well through the posterior opening (regardless of the fact that pus puddled in the oblique sinus) and the introduction of the Carrel tubes posterior to the heart was a relatively simple matter. Not only would this have been more difficult through an anterior incision, but the exposure of the heart to the additional length of tubing which would have been required certainly would not have been desirable.

In the past the posterior route has been opposed on the grounds that the pleura might be opened and the patient made to suffer the additional burden of a pneumothorax and fresh pleuritic infection. It may be that this objection is largely theoretical. In consideration of the findings in the case reported here and in that reported by Truesdale, one wonders whether pleural adhesions are not usually present in cases of suppurative pericarditis. They are certainly to be expected when the pericarditis is preceded by a suppurative pleurisy (which is usually the case) and it may well be that the pressure of a distended pericardium and the infection within are sufficiently irritative to the adjacent pleural surfaces to stimulate the formation of adhesions in those cases that are not preceded by empyema. If this is true, the belief that it is necessary to drain anteriorly in order to avoid infecting a healthy pleura is without foundation.

On the other hand, the desirability of draining a suppurative pericarditis without opening and infecting the pleura would not be denied by any one and for this reason it is felt that the posterior approach is particularly suited to those cases which are preceded by empyema. When there has been a preexisting empyema, the presence of adhesions makes it unlikely that free pleura will be entered. Furthermore, the posterior route probably should be restricted to the left side, because the base of the pericardium is lower on the left and the inferior vena cava is not present to obstruct the entrance to the oblique sinus (culdesac). If the expected adhesions are not present and

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free pleura is entered, drainage of the space will be provided from the time the infection is introduced and the effects of an open pneumothorax can be compensated by the use of some type of a pressure-maintenance drainage tube (Fig. 4). If this is done, the disastrous effects of the pyopneumothorax might be avoided. I feel it very important, however, to emphasize the importance of frequent irrigations.

The use of Dakin's fluid in this case is deserving of a word of comment. In consideration of the fact that Beck<sup>4</sup> found that the injection of Dakin's solution into the normal pericardial cavity of the dog was followed by a profound reaction, some of us hesitated to use it in the human. On the other hand, we knew that Dakin's solution had been used in the human pericardium in cases of acute suppurative pericarditis and that a number of cases in which it was used had gone on to complete recovery.<sup>4, 5</sup> When the exudate became thick and it was discovered puddling in the oblique sinus (culdesac) behind the left atrium, the advantages to be gained from an antiseptic, solvent agent seemed to be of paramount importance and consequently Dakin's solution was substituted for the physiologic salt solution which had been used up to this time. The Dakin's solution accomplished its purpose, for the residual exudate disappeared rapidly after its use was begun. However, it may be too early to conclude that it did not have a harmful effect. It may be, as Beck has suggested, that the fibrinous exudate in suppurative pericarditis protects the pericardial surfaces from the irritating effects of free chlorine. In support of this suggestion he describes his observations that injection of Dakin's solution into the infected pericardium of dogs does not cause pain and bleeding as it does in the normal pericardium.

Another feature in this case was the syndrome produced by the intrapericardial pressure. It presented all of the typical signs of this condition. The importance of their recognition in diagnosis and the mechanism by which they are produced have been described by Beck and Cushing.<sup>6</sup> As these authors suggest, it is unfortunate that the significance of this syndrome has not been more generally appreciated. Although it was understood that there was interference with the entrance of blood into the right heart, 500 cc. of whole blood were added to the circulation. This was done because the boy was anemic and septic. The result was a near fatality. This experience should be a warning. It demonstrates that an ability to recognize and interpret the signs of intrapericardial pressure is just as important from the standpoint of therapy as it is from the standpoint of diagnosis. Intravenous therapy should be cautiously withheld in these cases, and, if resorted to, fluid should be injected slowly and in small amounts.

### SUMMARY

(1) A left sided, posterior approach to the pericardium is recommended as the procedure of choice for drainage of suppurative pericarditis when the pericardial infection follows a left sided empyema.

(2) A case that recovered after the establishment of drainage by this



route is presented, including a detailed description of the history and physical signs, operative procedure and postoperative course.

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## PRIMARY CARCINOMA OF THE BRONCHUS TREATED SUCCESSFULLY WITH SURGICAL DIATHERMY \*

HERMAN J. MOERSCH, M.D.

DIVISION OF MEDICINE

AND

HARRY H. BOWING, M.D.

SECTION ON THERAPEUTIC RADIOLOGY

ROCHESTER, MINNESOTA

THE past decade has revealed a marked increase in the incidence of primary carcinoma of the bronchus. That this increase is not entirely dependent on improvement in diagnostic acumen and the wide use of the bronchoscope as an investigative procedure has been demonstrated by various observers. Junghanns,<sup>1</sup> from a study of patients who came to necropsy, noted an increase in the frequency of the disease in the past seventy-five years, and especially in the last two decades. Maxwell and Nicholson<sup>2</sup> have come to a similar conclusion from a review of 100 cases of primary carcinoma of the bronchus which were observed at necropsy at St. Bartholomew's Hospital (London, England) since 1867, and estimated that at the present time it comprises one-seventh of all primary carcinomata.

Experience at The Mayo Clinic has been of a very similar nature. Previous to 1925, it was our privilege to see very few cases of primary carcinoma of the bronchus. Since then, such a diagnosis has been made in approximately 250 cases, in 130 of which the diagnosis was confirmed by microscopic examination of tissue which was removed through the bronchoscope. In many of the other cases, the diagnosis has been confirmed at necropsy or by the demonstration of metastatic carcinoma in lymph nodes that have been removed for microscopic examination.

The disease apparently reached its present formidable position somewhat earlier abroad than it did in this country. Staehelin,<sup>3</sup> of Basel; Berblinger,<sup>4</sup> of Jena; Kikuth,<sup>5</sup> of Hamburg; and Seyfarth,<sup>6</sup> of Leipzig, as early as 1925, reported an incidence varying from 4.9 to 15.5 per cent of all primary carcinomata. It was not until some years later that similar percentages were encountered in the United States.

While many theories have been advanced to explain the increased frequency of the disease, none has proved entirely satisfactory. It is therefore readily apparent that the treatment of primary carcinoma of the bronchus has come to assume a place of major importance in diseases of the chest.

The greatest obstacle in the treatment of primary carcinoma of the bronchus has been the everpresent problem of early diagnosis. While the diagnosis is comparatively easy in cases in which the lesion is well developed,

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the reverse is true in its incipient form. In many cases, the condition is discovered during the course of a roentgenologic examination of the thorax. It is not uncommon for the first symptom to be caused by a metastatic lesion rather than by the primary growth. Rogers,<sup>7</sup> in a review of 50 cases of primary carcinoma of the bronchus which came to necropsy, reported that in 44 per cent the first symptom was the result of metastasis rather than of the primary tumor. Carlson and Ballou<sup>8</sup> have come to a similar conclusion, but point out that metastasis does not always necessarily occur early.

It therefore must be emphasized that any patient who has indefinite pulmonary symptoms, with or without roentgenoscopic findings, should be given the advantage of a thorough bronchoscopic examination, as there is no other means by which a small and early lesion of the bronchus can be recognized definitely.

Some doubt exists in the minds of various pathologists as to what comprises a primary carcinoma of the bronchus. There is no doubt that it is often extremely difficult to classify such tumors because of the small amount of tissue which is obtained through the bronchoscope. The diagnosis requires the greatest experience and skill on the part of the pathologist. In our experience,<sup>9</sup> primary carcinoma of the bronchus invariably has a high degree of malignancy when graded according to the method of Broders.

There exists a marked difference of opinion regarding the most satisfactory form of treatment of primary carcinoma of the bronchus. Some doubt has been cast on the value of various therapeutic measures and on the accuracy of the pathologic interpretation of the tumor, because of the fact that an occasional patient, who is known to have a primary carcinoma of the bronchus, may live for years without treatment of any kind. It has been our experience, however, that such is the exception rather than the rule. The life expectancy in the cases which we have seen after the establishment of the microscopic diagnosis was slightly more than five months in the cases in which no treatment was employed.

Roentgenotherapy has enjoyed the greatest popularity in the treatment of primary carcinoma of the bronchus, because of its ease of administration and its applicability in all types and stages of the disease. Many observers, however, feel that it is of very limited value. Graham and Singer<sup>10</sup> said that "There is no record in the literature of the successful treatment by radiotherapy of a single case in which the pathologic evidence has been incontrovertible, and in which a five year interval without recurrence has elapsed between the treatment and the time of reporting the case." Our experience with roentgenotherapy has not been as discouraging as that of these authors. While we agree that its benefits are limited, Vinson and Leddy<sup>11</sup> have demonstrated that it produces very gratifying results in a small percentage of cases. Vinson<sup>12</sup> has recently reviewed our experience at the clinic with this form of treatment and has found that a number of patients are still alive and well seven years after the diagnosis was established microscopically.

Thoracic surgery has made encouraging progress in recent years in deal-

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ing with primary carcinoma of the bronchus. Graham,<sup>13</sup> in 1934, reported six successful surgical extirpations of malignant growths of the bronchus which had been reported in the literature up to that time. In one of these cases, the patient was alive and well five years later. Since then, additional successful operations have been reported and much is to be hoped for from this method of treatment. It will require, however, some time to evaluate its true value and worth.

The treatment of primary carcinoma of the bronchus directly through the bronchoscope has been found of distinct therapeutic benefit in certain cases. In spite of this, it has not received the attention that it deserves. Bronchial drainage may not only be reestablished, but in favorable cases, the growth may be removed or destroyed by direct excision, surgical diathermy, and the local application of radium.

Jackson<sup>14</sup> was the first to call attention to the feasibility of the bronchoscopic removal of malignant tumors of the bronchus. In 1917, he reported the successful removal of an endothelioma from the bronchus, by bronchoscopy. The patient is alive and well today, 19 years after the operation. This result is unequaled today by any other therapeutic measure. Orton,<sup>15</sup> in 1924, reported the first successful removal of a primary carcinoma of the bronchus. His patient presented all the classic findings which have come to be associated with the disease. In addition, microscopic examination of the tissue which was removed confirmed the diagnosis. He informed us that the patient is alive and well today, 13 years after the removal of the growth. Negus,<sup>16</sup> in 1933, reported the successful removal of an adenocarcinoma of the bronchus by means of bronchoscopy. The patient was alive and well, three and one-half years later. Kernan<sup>17</sup> reported a most instructive group of cases in which there was primary carcinoma of the bronchus that he has treated through the bronchoscope with a combination of excision, surgical diathermy and radon seeds, with most encouraging results. Arbuckle<sup>18</sup> also has used surgical diathermy in the treatment of a patient who had primary carcinoma of the bronchus. The patient lived in comfort while under treatment, for four and one-half years before dying of metastasis. Figi,<sup>19</sup> in 1930, reported the successful destruction of a primary carcinoma of the trachea by surgical diathermy. The patient was alive and well six years later. In 1926, Vinson and Bowing<sup>20</sup> first described the value of surgical diathermy in the treatment of tumors of the trachea and bronchi, and have found it of increasing value.

To this very encouraging group, we wish to add the report of a case which emphasizes the value of surgical diathermy in the treatment of primary tracheobronchial carcinoma.

### CASE REPORT

A man, aged 65 years, first came to the clinic in May, 1933, complaining of dyspnea and expectoration of a thick mucopurulent material. His difficulty had commenced two years previously and had become progressively worse. On physical examination,

the breath sounds were markedly diminished over the entire right half of the thorax. There were scattered coarse râles. The roentgenograms of the thorax did not disclose anything of diagnostic importance. Examination of the blood and sputum did not reveal anything abnormal. Bronchoscopy was advised, but was rejected, to await further developments. The patient again returned to the clinic August 9, 1933. The dyspnea had increased very rapidly and the patient was having marked distress. There was a marked stridor and he was expectorating mucopurulent material. The physical and roentgenographic findings were the same as they had been at the time of the patient's previous visit to the clinic. Immediate bronchoscopy was advised. On introducing the bronchoscope into the trachea, a large tumor was readily visualized in the lower end of the trachea, almost completely obstructing its lumen. There was a very narrow crescent shaped slit (Fig. 1) between the tumor and the left wall of the trachea, through which the air passed. Purulent material exuded from this slit. It was impossible to determine the origin of the tumor, but it appeared to arise from the outer wall of the left main bronchus. Examination of tissue that was removed from the growth proved to be adenocarcinoma Grade I (Figs. 3 and 4). The condition of the patient was so precarious that immediate increase in the airway was imperative. The



FIG. 1.  
FIG. 1.—Bronchoscopic appearance of adenocarcinoma of right bronchus.  
FIG. 2.—Bronchoscopic appearance of same tumor as in Fig. 1, but after three treatments with surgical diathermy.

tumor, however, was situated too far down in the trachea to obtain relief by tracheotomy. The use of radiotherapy seemed inadvisable because of the possible danger of producing edema and complete tracheal obstruction.

In view of the excellent results which we had had previously with surgical diathermy in the treatment of tracheal tumors, it was decided to apply it here. Two days later, bronchoscopy was performed and a sufficient amount of the tumor was destroyed by surgical diathermy to permit air to pass readily into the lungs. The patient immediately improved and felt much more comfortable than he had before the bronchoscopy. The following day, he coughed out a piece of tumor the size of a bean, which gave him increased comfort. The breath sounds, however, remained diminished over the right half of the thorax. Bronchoscopy was repeated August 18, 1933, a week following the first treatment, and revealed a marked change in the size of the tumor. It now occupied the right half of the transverse diameter of the lower tracheal lumen and the bifurcation could be visualized. Since then, surgical diathermy has been applied to the tumor five times. It was only after the third treatment that the site of the origin of the tumor could be determined definitely. It was found to arise from the lateral wall of the right main bronchus, just below the bifurcation, and filled most of the right main bronchial lumen (Fig. 2). It was not until surgical diathermy was applied to the tumor in the right main bronchus that breath sounds again appeared over



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the right half of the thorax. At the time of the last treatment, December 7, 1934, the only thing discernible was a slight infiltration on the lateral wall of the right main

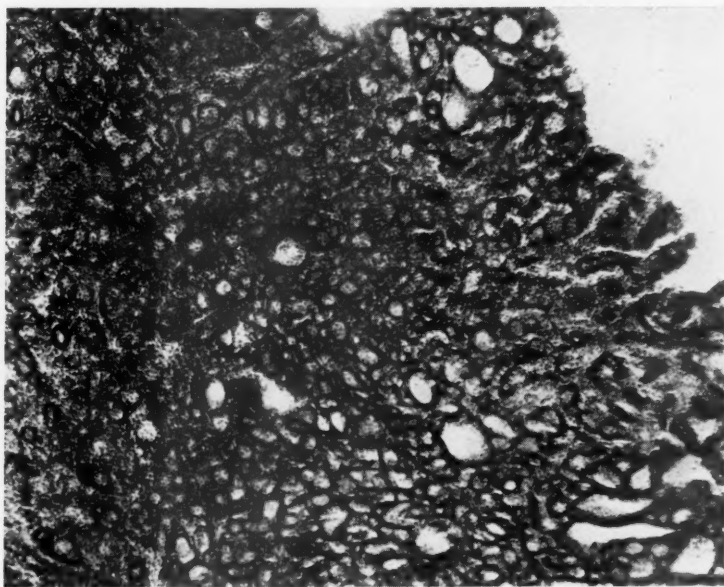


FIG. 3.—Adenocarcinoma of bronchus ( $\times 60$ ).

bronchus at the junction with the bronchus to the right upper lobe. In addition to surgical diathermy, the patient received two courses of roentgenotherapy to the thorax,

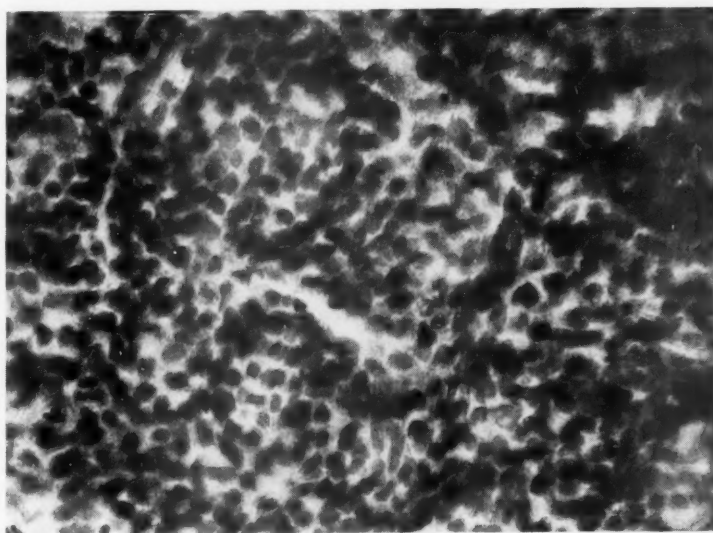


FIG. 4.—Adenocarcinoma Grade I of bronchus ( $\times 360$ ).

in November, 1933, and January, 1934. The patient is in the best of health at the present time, 22 months after the first bronchoscopic treatment, and is performing heavy farm work without the least distress.

In conclusion, it may be said that in certain selected cases, the use of surgical diathermy applied perorally through the bronchoscope will be found of value in the treatment of primary carcinoma of the bronchus.

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## CARCINOMA FOLLOWING GASTRIC AND DUODENAL ULCER\*

PAUL KURT SAUER, M.D.

NEW YORK, N. Y.

FROM THE SURGICAL SERVICE OF DR. HERMANN FISCHER, LENOX HILL HOSPITAL, NEW YORK, N. Y.

THE relation of gastric carcinoma to gastric ulcer furnishes a fertile field for controversy, and despite a vast accumulation of literature the question remains undecided. Statistics too often represent a dogmatic personal viewpoint and so suffer from distortion, unconscious and unintentional. This paper presents a statistical analysis of 182 cases of ulcer, and 255 cases of carcinoma of the stomach and duodenum from the surgical services of the Lenox Hill Hospital. No attempt has been made to arrive at any one conclusion, or to prove any particular point.

The compilation includes all cases of gastric and duodenal ulcer operated upon from 1911 to 1930, inclusive, and the gastric carcinomata from 1923 to 1934, inclusive. The gastric and duodenal ulcer cases later than 1930 are not presented because, for the purposes of this paper, the time interval for the development of carcinoma following ulcer is not sufficiently long. The gastric and duodenal ulcers are included in one group because many of the cases where no resection was done were of such nature that the surgeon performing the operation called the lesion "pyloric ulcer," probably because it was impossible at the time to state definitely on which side of the pylorus the ulcer was actually situated. Because of the extreme rarity of carcinoma of the first portion of the duodenum, and the marked frequency of ulcer of this organ, the likelihood of a carcinoma developing at the site of a duodenal ulcer is slight. At the Lenox Hill Hospital there is only one case of carcinoma of the first portion of the duodenum following an ulcer on record (autopsy report). Jefferson<sup>10</sup> collected 30 cases of supposed carcinoma of the duodenum developing in ulcer, and discarded most of them.

For the purposes of this article the cases will be reviewed in two groups: (1) Gastric and duodenal ulcers operated upon which could be followed long enough to determine whether or not carcinoma developed later on. (2) All proven cases of carcinoma of the stomach.

That no absolute proof can be presented is obvious. In the first group are many cases in which no resection was done and where, naturally, no microscopic examination of the ulcer could be made. Hence, the gross examination of the surgeon at the time of operation must be relied upon. That this is not always infallible is well known. The cases in which perforation was the immediate indication for operation are especially unreliable for statistical purposes because a macroscopic diagnosis at the time of operation

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is not sufficiently accurate to distinguish between ulcer and early carcinoma. If all such perforation cases could be followed for a number of years, it would help somewhat, but, of course, many cannot be found even after a year or two.

The second group (the carcinomata) is unreliable except by assumption, because even if there is a preceding ulcer history, the differentiation between gastric and duodenal ulcer leaves much to be desired. It might be argued that a gastric carcinoma developing after an ulcer history of long standing must have had the carcinoma developing on a gastric ulcer rather than on a duodenal ulcer. On the other hand, however, one might assume that the patient at one time had a duodenal ulcer, which may or may not have healed, and that the gastric carcinoma developed independently. It is true that in such a case the duodenal ulcer should leave some trace of its preexistence, but the gastric carcinoma may have so overgrown it as to eradicate any signs.

From whatever angle the subject is attacked there are widely divergent views. Hauser,<sup>13</sup> in 1883, was one of the first to prove histologically the close connection between ulcer and carcinoma. He confirmed the previously published assertions of Cruveilhier, Rokitansky, Leube, Lebert, Brinton, and others. Orth<sup>14</sup> called attention to the fact that frequently neither the surgeon nor the pathologist was able to determine the preexistence of an ulcer because the neoplasm had so overgrown the original ulcer, and even its scar, that the evidence was totally eradicated. It is known that frequently these neoplasms develop many years after the original ulcer, and that just as frequently the patients fail to mention or have forgotten that they ever had ulcer symptoms. Again, there are ulcer cases that run a quiescent course without any marked symptoms and these would be lost so far as statistics are concerned, except where a resection is done for carcinoma and the ulcer base is discovered by the pathologist. Five of our cases fall into this group.

Statistics in the literature give the incidence of carcinoma developing on gastric ulcer all the way from 2 to 100 per cent. Zenker claimed that all gastric carcinomata arose from preexisting ulcers. The Mayo Clinic reports an incidence of 4.1 per cent. Albu in a thorough review of the subject of carcinoma of the stomach states that he is inclined to believe that fully one third of the carcinoma cases have their origin in an ulcer. In 1914, Joslin,<sup>6</sup> in a review of 213 cases of gastric ulcer, reported 12 or 6 per cent had died of cancer up to that time. He admitted that his statistics were complete for only the 46 patients who had died. "In other words, one of every four patients with ulcer of the stomach or duodenum which have been followed to their death, died of cancer."

Interpretations of microscopic sections are subject to great individual variance. Especially is this true in the category of the early degenerative changes, and consequently statistics based upon such examinations will vary greatly. Ewing concludes that the great majority of ulcerating conditions of the stomach are either ulcerating carcinomata or simple benign ulcers. In 1909, MacCarty<sup>11</sup> stated "that 71 per cent of our resected specimens for

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gastric carcinoma were associated with ulcer." Most pathologists are disinclined to accept all of MacCarty's histologic criteria of malignancy.

The question is of importance to the surgeon doing much gastric work. If one believes that ulcers are the basis for gastric carcinoma in a great percentage of cases, it will lead one to a more radical type of treatment. This last statement may not hold good for many more years, as radical resections for gastric ulcers are becoming more and more frequent. Finney and Hanrahan<sup>8</sup> state the following: "We do not feel that 70 per cent of chronic ulcerated lesions unaccompanied by tumor or metastases are carcinomatous. We feel that about 85 per cent of simple ulcers are recognizable as such on the basis of chronicity, the character of the edges, and the absence of tumor or metastases. Of the remaining 15 per cent on microscopic examination about 5 per cent will be found entirely benign; another 5 per cent will present recognizable carcinoma; while the remainder will require microscopic study of serial sections to ascertain their true character."

In a comparative review of the cases of gastric and duodenal ulcer with the carcinoma cases, some interesting data have been obtained.

*Age Incidence.*—The youngest ulcer case was 19 years of age, the oldest 65, the average 39.1. By decades the percentages are:

Years	Percentage	
11 to 20	2.5	
21 to 30	16.0	
31 to 40	28.8	53.8 per cent occurring between the ages of 31 to 50
41 to 50	25.0	
51 to 60	23.7	
61 to 70	4.0	

Among the carcinoma cases the youngest was 25 years, the oldest 80, the average 60.5. By decades the percentages are:

Years	Percentage	
21 to 30	1.17	
31 to 40	10.0	
41 to 50	22.7	59 per cent occurring between the ages of 51 to 70
51 to 60	29.2	
61 to 70	29.8	
71 to 80	3.52	

These ages are very similar to those reported by others. Cases below the age of 30 years of age, however, are uncommon enough to excite considerable interest. Mintz reported a case of carcinoma of the stomach in an 11 year old boy; Marble in a 17 year old girl. Osler and MacCrae collected six reported cases in persons under ten years of age. Smithies<sup>12</sup> published a study of gastric carcinoma in patients under the age of 31, and reported 16 cases.

*Sex.*—The incidence of ulcers and of carcinoma in the two sexes were quite divergent. Of the 182 ulcer cases 156 occurred in men, and 26 in women; a proportion of 7 to 1. Of the 255 cases of gastric carcinoma 180



occurred in men and 75 in women; a proportion of  $2\frac{1}{2}$  to 1. At the Charity Hospital in New Orleans, out of 758 patients suffering from carcinoma of the stomach, 86 per cent were males.

In order to arrive at any definite conclusions regarding the development of carcinoma following ulcer certain criteria were established upon which to base our statistics. Unless a patient had been previously operated upon and a gastric ulcer definitely proved, the following qualifications had to be met:

- (1) A typical ulcer history.
- (2) At least one full year's duration of symptoms without undue loss of weight or signs of cachexia.
- (3) The roentgenographic findings, if any.
- (4) Clinical pathologic findings, if any.
- (5) Pathologic report of carcinoma following ulcer.

About 20 per cent of the 182 cases of gastric or duodenal ulcer could be followed. Of these only one developed carcinoma of the stomach.

#### CASE REPORT

This man was admitted to the Lenox Hill Hospital in 1919, complaining of epigastric pain after meals for a period of seven years, accompanied by gaseous eructations and occasionally vomiting. There was never any hematemesis, but he admitted having had tarry stools. On admission his hemoglobin was 75 per cent, the urine was negative, as was also the Wassermann. A. C. test meal showed a free hydrochloric acid of 38, and a total of 58. P. C. test meal showed 24 and 40, respectively. The physical examination was negative except for some epigastric tenderness. In 1913, an appendicectomy had been performed at the General Memorial Hospital, and he had subsequently been treated medically for an ulcer at both the Roosevelt and the Lenox Hill Out-Patient Departments. May 19, 1919, at Lenox Hill Hospital a posterior gastroenterostomy was done for a "phlegmonous condition of the pylorus." It was noted that the gallbladder and the ducts were normal. A lymph node was excised for microscopic section. The pathologic report by Doctor Humphries stated "hyperplastic lymphadenitis; no evidence of malignancy." In 1922, he was again operated upon and a carcinoma of the stomach removed. He died in October, 1923, from recurrent carcinoma of the stomach with generalized metastases.

Of the 255 cases of carcinoma of the stomach 32 have a distinct and definite previous ulcer history, or had a resection done for an ulcer a portion of which was malignant; a percentage of 12.8. There were 12 other cases (4.8 per cent) that had a history closely simulating ulcer but which was questionable enough to warrant placing them in a separate group. These figures approximate those of Maes, Boyce, and McFettridge,<sup>7</sup> who reviewed the 758 cases at the New Orleans Charity Hospital, previously mentioned. Using practically the same criteria, they stated that 25 per cent of the cases gave a typical ulcer history.

**Mortality.**—The operations were performed by 17 surgeons. The hospital mortality of the 255 cases of carcinoma of the stomach is 34.5 per cent. The immediate mortality of the 201 cases operated upon is 33 per cent. Forty-nine (19.2 per cent) of the cases were submitted to resection with a mortality

# CARCINOMA FOLLOWING GASTRIC ULCER

of 42.8 per cent. Sixty-three or 24.7 per cent of the cases were treated by gastro-enterostomy with a mortality of 30 per cent. Eighty-nine or 34.5 per cent of the cases permitted no more than an exploratory laparotomy with a mortality of 31.4 per cent. The fifty-three cases not operated upon showed a mortality of 30.2 per cent. These figures agree pretty well with reports from other clinics (TABLE I).

TABLE I

Report from	Per Cent of Cases Resected	Mortality Per Cent	Per Cent of Cases Gastro-enterostomy	Mortality Per Cent	Per Cent of Exploratory	Mortality Per Cent
Lenox Hill.....	19.2	42.8	24.7	30	34.5	31.4
St. John, F. B. <sup>2</sup> .....	....	43.7	....	26.6	....	....
Maes, Boyce, and McFettridge	17.5	51.4	41.5	43.6	....	....
Oughterson <sup>3</sup> .....	....	40.3	....	28.3	....	....
Salzstein and Sandweiss <sup>1</sup> .....	....	64.0	....	66.0	....	....
Persson, M. <sup>5</sup> .....	....	28.0	....	23.1	....	17.1
Anschütz and Konjetzki.....	....	34.5	....	28.5	....	9.0
Balfour.....	200 cases	5.0	....	....	....	....

In New York the follow-up of the cases is most difficult. We were able to follow only about 25 per cent of the cases for any length of time. Some disappeared without a trace as early as three months after discharge. The European clinics with their more stable populations and police registration can pursue their follow-ups much better. Persson<sup>5</sup> was able to follow all but three out of 269 cases for as long as 20 years.

Of the 43 that were traced at Lenox Hill, two cases lived two years. One case is still alive and well after four years. One case is alive and well after five years. One case is alive after eight years. Although he complains of abdominal symptoms and does not gain weight, no evidence of recurrence can be found. One case is alive and well after nine years. One case died from a recurrence 11 years after a resection, having been well and enjoyed life until a few months before death. The average length of life of the remaining cases traced was 5.6 months.

## SUMMARY

(1) One hundred eighty-two cases of gastric and duodenal ulcers operated upon from 1911 to 1930, and 255 cases of carcinoma of the stomach, of which 201 were operated upon, are reviewed.

(2) Among the ulcer cases one developed carcinoma.

(3) Of the carcinoma cases 32 gave a history typical of ulcer, or the pathologic specimens showed ulcer coexistent with carcinoma.

(4) Twelve others had a history closely simulating ulcer, but questionable enough to be placed in a separate group.

(5) Even in the cases of associated ulcer and carcinoma both are sufficiently frequent to raise the question of possible coincidence.

I wish to express my thanks and appreciation to Dr. Walter T. Stenson for his assistance in gathering the statistics of the ulcer cases from 1911 to 1924, and to Dr. Francis D. Huber for placing his compilation of the ulcer cases from 1925 to 1930 at my disposal.

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DISCUSSION.—DR. CARL EGGERS (New York) said that his interest had been aroused by the statistics presented by Doctor Sauer. He had been under the impression from clinical observation that ulcer and carcinoma were not commonly associated, and that cancer is rarely grafted onto an old ulcer. Cancer patients come in as cancer patients with a short history of disability, and without any previous symptoms suggestive of disease of the stomach, this very insidiousness of onset being most often responsible for late diagnosis. If a definite association between ulcer and carcinoma is demonstrated in a large number of cases, it behooves one to do radical surgery even if ordinarily not radically inclined in regard to the therapy of ulcer. The greatest aid in determining malignancy before operation is received from the radiographic department. Although examination of the stomach contents is often of value. On the whole it has been the insistence of the roentgenologist, particularly in lesions of the prepyloric region, that has influenced surgeons to operate radically.

Among 54 cases of gastric carcinoma in his own experience, there were 25 resections, of whom five died, or an operative mortality of 20 per cent; seven patients died at home, and 13 are still living. Of those living, one has been well for ten years, two for nine years, one for five years, two for three years, one for two years, one for one year and five less than one year.

With regard to lymph node involvement at the time of operation, the 16

per cent still living after five years had no involvement of lymph nodes. On the other hand, one patient who lived nearly five years, and another who lived four years, had involvement of the nodes at the time of operation. A third case who died of acute cholecystitis and cholangitis two years and three months after a gastric resection for carcinoma of the stomach with metastasis, failed to show any evidence of metastases after a careful autopsy.

It is frequently not possible at the time of operation to determine definitely whether enlarged lymph nodes are involved. Certainly they should never make one decide against a radical operation as long as they are removable. Most of these patients have enlarged lymph nodes which show simple hyperplasia. The results with gastro-enterostomy had not been good, there being 50 per cent hospital mortality, and exploratory laparotomies had been followed by a mortality of 18 per cent.

Reviewing all the histories of the 54 cases in an attempt to determine the relationship of ulcer to cancer, it was found that in 18 per cent there was an old or a more recent history of some gastric disorder, which in a few was strongly suggestive of ulcer. Among the 25 patients in whom a resection was done, the pathologist was reasonably certain that in four there was association of ulcer and carcinoma.

Doctor Eggers felt that, on the whole, there is opportunity to improve results in carcinoma of the stomach. If the patient could be seen a little earlier and if good radical surgery, including the affected portion of the stomach and its lymph node drainage area, could be done, better results might be expected. Several factors are of help in this, one being earlier radiographic examination of patients with suspicious stomach symptoms as a step to earlier diagnosis, and the other improvement in preoperative and operative technic. Emptying the patient's stomach and keeping it clean is of the greatest value as a preoperative measure. This should be supplemented by the administration of adequate quantities of fluids with glucose and perhaps transfusions before and after operation. During operation, the use of a de Petz sewing machine is of the greatest value, avoiding leakage and thereby preventing contamination, and shortening the time of operation.

DR. F. W. BANCROFT (New York) stated his belief that if cases of carcinoma occurring as a result of ulcer are to be analyzed statistically, there should be a further subdivision of the region to be considered. Duodenal ulcer has already been ruled out, but one should go further and separate lesions of the lesser curvature from the pyloric antrum. In other words, in penetrating ulcers of the lesser curvature of the stomach malignancy is relatively rare. The site where malignancy apparently occurs most often is in the pyloric antrum. If one proceeds on the assumption that carcinoma is apt to occur in the cardia or on the lesser curvature, and operate on that case without giving it a chance to heal under medical treatment, the mortality is raised to a considerable degree. In one of Doctor Bancroft's cases, Dr. Lewis Gregory Cole divided the ulcer in half and sent sections of each half to a group of eight pathologists. However, he labeled each half with a different name so that the examiners were unaware that they came from the same individual. One group of eight described one side of the ulcer as benign, while six of the eight described the other half as carcinoma, and the remaining two as some form of malignancy. There was apparently a perfectly benign side to the ulcer, on which all agreed, not knowing it came from the same case, and on the other side almost all agreed that it was carcinoma, and all that it was malignant.

DR. RICHARD LEWISOHN (New York) said that the operative mortality in carcinoma of the stomach will always be comparatively high if one is will-

ing to extend the indications for resection as far as possible. It is very easy to keep the mortality down if only the favorable cases of gastric carcinoma are subjected to a radical resection.

After looking over the cases of carcinoma of the stomach at Mt. Sinai Hospital recently, Doctor Mage told Doctor Lewisohn of a very interesting observation, showing how hopeless today is the surgical attempt to cure carcinoma of the stomach. Of 100 cases entering Mt. Sinai Hospital with carcinoma of the stomach, only two are alive and well after five years. He arrived at this figure in the following manner: A certain percentage are admitted and refused operation; another percentage is turned down as inoperable; another group is subjected to operation only to have found an inoperable condition. In a fourth group, a gastro-enterostomy is performed, and only 33 per cent of those coming up to the operating room are not too far advanced to have a partial or subtotal gastrectomy performed. Among the latter group very few are alive and well after five years. This shows again the hopelessness of the condition at the present time. All suspicious cases of lesser curvature ulcer should be subjected to radical surgery, in Doctor Lewisohn's opinion. In spite of the excellent roentgenographic work in all hospitals, a number of cases reported as benign by the radiographic department turn out, at operation, to be malignant. Any case that does not respond very quickly to medical treatment should be subjected at an early date to operative exploration. The mortality for subtotal gastrectomy in gastric carcinoma at Mt. Sinai Hospital is about 33 per cent, this comparatively high figure being due to the fact that wherever possible an attempt is made to be radical and not to turn down the case as inoperable.

DR. ALLEN O. WHIPPLE (New York) stated that in Presbyterian Clinic there are now eight patients who have reported for a 10 to 18 year period following resection of carcinoma of the stomach, giving a percentage of 33 per cent of patients who have been resected and followed for a period of ten years. These cases, however, have belonged to a relatively benign group of carcinoma, the fungating type that is not as malignant as the infiltrative type.



## JEJUNAL ULCER \*

E. STARR JUDD, M.D.,

THE MAYO CLINIC

AND M. TISCHER HOERNER, M.D.

FELLOW IN SURGERY, THE MAYO FOUNDATION

ROCHESTER, MINNESOTA

THE development of jejunal ulcers following operations performed in the treatment of diseases of the stomach and duodenum is of interest to the surgeon not only because it constitutes a serious surgical complication, but also because the lesion is one for which the primary procedure is responsible. Jejunal ulcer is associated with the development of gastric surgery, and therefore experience with the condition has likewise gradually increased.

### INCIDENCE

A great mass of information has accumulated on this subject, and it appears that there is no surgical procedure uniting the stomach and jejunum that will offer a guarantee against the subsequent development of jejunal ulcer. Berg,<sup>1</sup> Lewisohn,<sup>7</sup> Strauss,<sup>20</sup> Hurst and Stewart<sup>5</sup> all condemn gastro-jejunos-  
tomy, which is the procedure that has been used more often than any other in the treatment of peptic ulcer. Their statistics suggest that this operation is complicated by the formation of jejunal ulceration in 20 to 52 per cent of cases. Surgeons in Germany have also discarded gastro-jejunos-  
tomy and in its place they advocate some form of partial resection for the treatment of peptic ulcer. Others are of the opinion that European surgeons are dealing with an entirely different type of lesion than that ordinarily encountered among patients in America. Consequently, the statistics obtained in these two countries are not comparable.

There are many who believe that while jejunal ulceration is not entirely unavoidable after conservative operations, the incidence of such ulceration is too small to justify the substitution of radical measures. Paterson<sup>14</sup> found the incidence of jejunal ulcer to be 2.4 per cent in a series of 495 operations, whereas Moynihan reported an incidence of 1.6 per cent in a series of 613 patients who underwent gastrojejunos-  
tomy. The occurrence of the lesion varied between 1.2 and 3.2 per cent in the two series of cases published by Walton<sup>22, 23, 24</sup> in which gastrojejunos-  
tomy was employed for duodenal ulcer. Luff<sup>8</sup> traced 744 patients who had been operated on for duodenal ulcer and found that only 21 had jejunal ulcer subsequently. Wright<sup>26</sup> believes that secondary ulcer occurs in about 6 per cent of patients after gastrojejunos-  
tomy for duodenal ulcer. Wilkie's<sup>25</sup> statistics revealed an incidence of 3.5 per cent in all cases in which he performed gastrojejunos-  
tomy for ulcer. Most of the figures resulting from studies of work done in this country are quite similar

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to these, for the incidence varies from 2 to 5 per cent if the statistics of Lewishohn and Strauss are excluded.

In a recent article on the subject of jejunal ulcer, Heuer has made a brief and concise statement of the general trend of thought with respect to the treatment of these lesions. He has drawn his conclusions from his own experiences and from published reports of those of other authors, and he says that the results of 17 authors from various countries show that recurrent or jejunal ulcer follows gastro-enterostomy in from 0.9 to 6.9 per cent of the cases, the average incidence being 3 per cent. He found that the statistics given by eight authors showed that recurrent or jejunal ulcer follows partial gastrectomy in from 0.6 to 6 per cent of cases, or an average of 1.9 per cent.

In the 20-year period beginning in 1912, when the first operation for jejunal ulcer was performed at the clinic, 597 patients have received surgical treatment for this condition. The primary operation was performed at the clinic in 278 cases and elsewhere in 319. From 1906 to 1931, gastrojejunostomy has been carried out at the clinic in 10,338 cases in the treatment of duodenal ulcer. If one considers only the 251 patients with proved jejunal ulcer who underwent gastrojejunostomy for duodenal ulcer at the clinic, the incidence of jejunal ulcer is found to be 2.4 per cent. However, it has been stated that the longer the period intervening after gastrojejunostomy, the higher the incidence of jejunal ulcer will be. In order to prove or disprove this assertion, we studied the course of the 251 patients from the time of primary operation to and including the year 1931. As Table I indicates,

TABLE I  
*Incidence of Jejunal Ulcer after Gastrojejunostomy Performed at the Clinic for Duodenal Ulcer*

Period During Which Gastrojejunostomy Was Performed	Total Patients	Returned with Jejunal Ulcer	
		Number	Per Cent
1906 to 1911.....	508	14	2.8
1912 to 1921.....	4383	121	2.8
1922 to 1926.....	3065	70	2.3
1927 to 1931.....	2382	46	1.9
Total.....	10,338	251	2.4

some of them underwent the primary operation in 1931. The 26-year interval between 1906 and 1931 has been divided arbitrarily into subperiods for the purpose of determining the incidence of jejunal ulcer after gastrojejunostomy. The incidence is greater in the first group than in the last, which is explained by the fact that a longer time had elapsed since gastrojejunostomy and consequently more of the individuals who will develop jejunal ulceration probably were included. A similar situation seems to obtain if a comparison is made

# JEJUNAL ULCER

between two consecutive groups. These findings tend to support Hurst's and Stewart's contention, but only to a certain extent, for it can be seen that although there is a gradual increase in the incidence of jejunal ulcer coincident with the time elapsed since gastrojejunostomy, a maximal incidence is eventually reached, as is shown by a comparison between the first and second groups. In other words, 2.8 per cent probably represents more nearly the true incidence of jejunal ulcer than is shown in the other groups. We have stated advisedly that this is approximately the true incidence of jejunal ulcer following gastrojejunostomy for duodenal ulcer, for we have been unable to trace all of our patients who have undergone this operation. Nevertheless, we are confident that there are comparatively few patients who have not reported to us when symptoms of jejunal ulceration developed.

*Age and Sex.*—The age and sex of patients with jejunal ulcer are also of interest. A study of the age distribution reveals that the highest incidence occurred during the third and fourth decades (Table II). Although jejunal

TABLE II  
*Age and Sex of Patients with Jejunal Ulcer Following Gastrojejunostomy*  
(1912 to 1931)\*

Age, Years	Males, Per Cent	Females, Per Cent	Total, Per Cent
10 to 19.....	0.2	4.7	0.5
20 to 29.....	8.7	9.3	8.7
30 to 39.....	33.1	32.6	33.1
40 to 49.....	36.8	27.9	36.2
50 to 59.....	16.1	16.3	16.1
60 to 69.....	4.7	9.3	5.0
70+.....	0.4	0.0	0.3
Mean age.....	41.8 years	42.6 years	42.5 years

Ratio of males to females: 12.9 to 1.

\* The first patient with jejunal ulcer was encountered in 1912, but he had undergone gastrojejunostomy at the clinic in 1906.

ulcer occasionally develops in those of advanced years (the oldest in this series being 71 years of age) the statistics reveal that, like peptic ulcer, the disease is primarily one of young adult life. And similarly, males seem to be more susceptible than females, for the proportion is at least 4 to 1 for primary ulcer, and approximately 13 to 1 for jejunal ulcer. However, the age distribution for the two sexes is about the same.

*Effect of Primary Lesion.*—The nature of the primary lesion appears to be an important factor in the subsequent development of jejunal ulcer.

Although the incidence of jejunal ulcer following gastrojejunostomy for gastric ulcer is extremely low, the lesion is rarer still following the same operation performed in the treatment of gastric carcinoma. In this respect, the results of the present investigation agree with the experience of others,

for in only one case was a jejunal ulcer observed under such circumstances. This seems particularly significant because of the anacidity or hypo-acidity that is usually associated with carcinoma of the stomach. Although it might be argued that these individuals do not live sufficiently long to form jejunal ulcers, a review of data on 393 patients living five years or more following partial gastrectomy for carcinoma of the stomach did not reveal one instance of subsequent jejunal ulceration. In the series of 597 patients with proved jejunal ulcer, the original lesion was a gastric ulcer in only 20 cases. Furthermore, in this group not a single jejunal ulcer developed in cases in which local excision combined with gastrojejunostomy seemed sufficient treatment for a small malignant gastric ulcer.

Jejunal ulcer may therefore be considered as a complication limited primarily to cases of duodenal ulcer in the treatment of which the jejunum has been anastomosed to the stomach. Table III shows the various procedures employed in the treatment of the primary lesion in the cases in this study.

TABLE III  
*Type of Operation Done for Primary Lesion*

	Duodenal Ulcer	Gastric Ulcer	Diagnosis Duodenal and Gas- tric Ulcer	Location? (Peptic)	Carcinoma of Stomach	Total
Gastrojejunostomy at clinic.....	251	5				256
Gastrojejunostomy else- where.....	202	3		93		298
Total.....	453	8		93		554
Enfolding ulcer and gas- trojejunostomy at clinic	3	1				4
Enfolding ulcer and gas- trojejunostomy else- where.....	1					1
Total.....	4	1				5
Excision of ulcer and gas- trojejunostomy at clinic	4	9				13
Excision of ulcer and gas- trojejunostomy else- where.....	7	1	1	5		14
Total.....	11	10	1	5		27
Partial gastrectomy at clinic.....	2	1	1		1	5
Partial gastrectomy else- where.....	4	—	—	2	—	6
Total.....	6	1	1	2	1	11
Total.....	474	20	2	100	1	597

## JEJUNAL ULCER

### ETIOLOGY

It has long been recognized that jejunal ulcer may develop after any operation in which the stomach is anastomosed to the jejunum. Although the probable causes of this lesion have been discussed at length in the literature, there is no uniformity of opinion in regard to the nature of the etiologic agent. In view of this fact, a few of the more widely accepted theories will be considered.

Much has been written concerning the importance of infection in the formation of an anastomotic ulcer. The frequency with which gastritis and jejunitis is associated with these lesions is emphasized by some authors. In addition, Saunders<sup>18</sup> has succeeded in isolating a streptococcus which he claims to be specific. Rosenow and Sanford<sup>16, 17</sup> were also of the opinion that foci of infection play a major part in the etiology of jejunal ulceration. On the other hand, Steinberg and Proffitt<sup>19</sup> are convinced that infection is only of secondary importance, because the mucosa at the juncture of the stomach and jejunum is particularly vulnerable to acid pepsin, especially when the general resistance of the subject is lowered. Dragstedt and Vaughan,<sup>2, 3</sup> Mann and Williamson<sup>10</sup> seem to be of the opinion that the ulcers which they studied were primarily due to chemical and mechanical factors.

It was formerly thought that the use of unabsorbable suture material contributed to the formation of jejunal ulceration. It is not difficult to understand how this opinion originated, for when one finds a piece of silk in the center of a jejunal ulcer, it is not unreasonable to assume that it might offer an explanation of the presence of the lesion. In this study, portions of suture material were found in 23 cases, constituting 3.9 per cent of the whole group. However, since catgut is employed almost always at the clinic in operations for benign peptic ulcer, we now know that anastomotic lesions cannot be prevented merely by the use of absorbable suture material.

Stress is frequently laid on the manner in which clamps are applied to the tissues in performing operations on the upper portion of the gastro-intestinal tract. Experimental work, however, has repeatedly demonstrated that acute traumatic ulcers heal rapidly and show no tendency toward chronicity; accordingly, we would expect these lesions to be healed by the time symptoms of jejunal ulcer usually appear. Furthermore, it is difficult to conceive of these instruments being of any etiologic significance if one takes into consideration the fact that anastomotic lesions are rarely found when the clamps were applied, and also that jejunal ulcer may even develop when the anastomosis is made without clamps.

Some of the various errors in technic which have been suggested as possible causes of jejunal ulceration are: (1) too small an opening in the anastomosis; (2) placing the stoma too high on the stomach; (3) inclusion of inflamed gastric mucosa in the anastomosis; (4) formation of a spur by redundant mucous membrane; (5) invagination of the jejunum into the stomach; (6) failure to approximate mucous membrane to mucous membrane;



(7) kinking of the distal loop, and (8) formation of a hematoma. While all of these factors must be considered and then be eliminated in order to obtain satisfactory results from the operation, they do not in themselves constitute the entire answer to the problem.

Of all the factors that have been mentioned as having a direct bearing on the formation of jejunal ulcer, that of hyperchlorhydria has received the widest acceptance. Vanzant, Alvarez, Berkson and Eusterman,<sup>21</sup> while engaged in establishing normal standards for gastric acidity, noticed that the value for free hydrochloric acid in males was higher than that in females. They then carried their investigation a step farther and discovered that patients with duodenal ulcer had higher values for free hydrochloric than those with gastric ulcer. Since almost everyone is agreed that duodenal ulcer is usually associated with hyperchlorhydria, it seemed of interest to study the gastric acidity of the patients who had the primary operation for gastric ulcer at the clinic.

In 17 of the 20 cases of gastric ulcer in which jejunal ulcer developed and in which gastric acidity was determined before gastrojejunostomy was performed, the average acidity was found to be 42.2 units. According to the standards of Vanzant and others, the average gastric acidity of a normal group of the same sex and age would be 42.5, that is, about the same value as that found for the group of patients with gastric ulcer. Vanzant and others, however, found that in a general group of persons with gastric ulcer, the average acidity is lower than normal by about 6 units. It would therefore seem that the gastric acidity in the group in which jejunal ulcer developed later was higher than that ordinarily found in cases of gastric ulcer. Increased gastric acidity may in part explain the development of jejunal ulcer in these particular cases. On the basis of such a theory, Walton<sup>22, 23, 24</sup> also explained the predominance among males of anastomotic lesions after operations for duodenal ulcer. It might even be argued that there are certain individuals, constituting 3 to 4 per cent of all those who receive treatment for peptic ulcer, who congenitally have an abnormally high gastric acidity, and that it is probably in these cases that jejunal ulcer develops subsequently.

The problem, however, is not as simple as this, for it should be stated that Vanzant and others did not find any greater acidity in the group with duodenal ulcer in which jejunal ulcer developed than in the group with duodenal ulcer in which a jejunal ulcer did not form after gastrojejunostomy. In addition, it must also be remembered that marked reduction in gastric acidity, or even achlorhydria, does not insure against the development of jejunal ulcer. Furthermore, it is evident that, at least at times, some factor of a different nature has more influence; for example, the values for pepsin are usually increased in the presence of duodenal ulcer, and there apparently is a higher degree of correlation between the amount of this ferment and the severity of the symptoms. In addition, one should not discard the idea that in the etiology of jejunal ulceration there probably are other factors as yet unknown, for jejunal ulcer may develop following gastrojejunostomy in

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cases in which there really never was an ulcer either in the stomach or in the duodenum.

### PATHOLOGY

We have found that 90 per cent of the jejunal ulcers were single, and that 48 per cent were situated in the line of the anastomosis. Walton<sup>22, 23, 24</sup> was of the opinion that the origin of all of these lesions can be traced by a linear scar to the site of union of the stomach and jejunum. Although our records indicate that only 29.5 per cent of the ulcers were on the jejunal side below the stomach and 7.6 per cent were on the gastric side of the opening, nevertheless we believe that the majority of these lesions are jejunal. In 14.3 per cent of the 597 cases the site of the lesion was not stated.

The characteristics of jejunal ulcer are quite similar to those ordinarily observed in peptic ulcer. If the lesion is acute, the walls are soft and there is danger of perforation. However, the chronic type of ulcer has thick, calloused walls and frequently has a deep crater. More than 43 per cent of the lesions were described as being of the penetrating variety. Pater-son<sup>12, 13, 14</sup> has stated that perforation is rare when the ulcer is situated in the stoma, but that ulcers situated at some distance below the anastomosis occasionally perforate before they are sealed off by a protective covering. When perforation occurs into the peritoneal cavity, an immediate operation is indicated. Fortunately, this does not happen frequently. In the process of protecting the base of an ulcer, adjacent structures may become involved and marked edema may ensue as a result of the inflammatory reaction. Owing to the proximity of the colon, it is particularly vulnerable, and if the penetrating tendency continues, a gastrojejunocolic fistula may develop. This occurred in 52 cases in our study, or in 8.7 per cent. Occasionally, when the condition is neglected, the abscess may involve the abdominal wall and finally erode through the skin. On the other hand, the ulcer will sometimes tend to heal, but, as a result of contracture of the scar tissue, various degrees of obstruction will be produced in the anastomotic stoma, and even in the colon if it is involved. In approximately 10 per cent of the cases there was evidence of stenosis of the stoma.

### SYMPTOMS

The presence of another ulcer should be suspected if there is a recurrence of symptoms more or less identical with the original manifestations, including pain following gastrojejunostomy or resection. The period of relief before symptoms returned after gastrojejunostomy is given in Table IV.

In 34 per cent of our cases in which jejunal ulcer was proved, the symptoms reappeared within six months after the primary operation and in approximately 50 per cent within a year. This fact is extremely important, for until it was recognized that a high percentage of jejunal ulcers would develop soon after the primary operation, the condition was frequently neg-

TABLE IV  
*Period of Relief Following Gastrojejunostomy*

Period of Relief, Years	Cases	Per Cent
Less than $\frac{1}{2}$ .....	199	34.0
$\frac{1}{2}$ to 1 .....	73	12.5
1 to $1\frac{1}{2}$ .....	60	10.1
$1\frac{1}{2}$ to 2 .....	30	5.1
2 to 3 .....	37	6.3
3 to 4 .....	28	4.8
4 to 5 .....	15	2.6
5 to 10 .....	62	10.3
10 to 15 .....	9	1.5
15 to 20 .....	3	0.5
Not stated.....	70	12.0
Total.....	586	100.0

lected for a length of time sufficient to permit perforation or the onset of other serious complications which greatly increased the risk of reoperating. Table IV also shows that the percentage of cases in which jejunal ulcer developed diminishes rapidly after the two or three year period immediately following the primary operation. However, it has been found that a patient may enjoy complete relief for years and then either gradually or suddenly have evidence of the presence of the disease.

When the symptoms recur after operation, complexities are introduced by virtue of the possibility of the presence of jejunal ulcer or reactivation of the original lesion, which is usually a duodenal ulcer. The presence of a jejunal ulcer, however, is usually attended by greater severity and progressiveness of the clinical course and more intractability to treatment. Owing to the fact that ordinarily jejunal ulcer does not tend to heal, there is a greater tendency to hemorrhage and to other complications. In many respects the symptoms accompanying chronic uncomplicated jejunal ulcer are strikingly similar to those resulting from the primary lesion, except that the form and area of deep tenderness has usually shifted downward toward the umbilicus, and at times to the left of it. When the jejunal lesion is of the penetrating type, pain may extend even lower in the abdomen. This pain was described as being severe in 24 per cent of the cases and as moderate in 40 per cent. Forty-two per cent of the patients complained of a penetrating type of pain extending through to the back. The periods of relief from pain are usually brief and incomplete. Other characteristics are likely to be: early onset of distress after eating, ineffectiveness of alkalis, and eventual incompleteness or brief duration of relief from all measures. In this study, 33.7 per cent of the patients gave a history of vomiting of blood or of passing tarry stools. Melena is more frequent than hematemesis, and oozing with resulting anemia is not uncommon.

The symptoms and signs of diagnostic importance are: (1) gastric hemorrhage, especially in the absence of bleeding before the primary operation; (2) gross gastric retention; (3) gastrojejunocolic fistula, and (4) progressive course and lack of satisfactory response to medical treatment. Since penetration characterizes the majority of jejunal ulcers, this tendency and the development of grave complications are the best justification for early surgical intervention in the severe intractable cases.

*Gastrojejunocolic Fistula.*—It is interesting to observe that gastrojejunocolic fistula practically never occurs in women, for of the 52 cases in this study in which fistula was present, in only one was the patient a woman. Judging from the statistics obtained during this investigation, the incidence of fistulous communication with the colon in cases of jejunal ulcer is 8.7 per cent. However, the records frequently contained reference to impending perforation, and it is evident that considerable risk is assumed in deferring surgical interference in intractable cases of jejunal ulcer or in those in which there are symptoms of perforated jejunal ulcer.

One of the most common manifestations of gastrojejunocolic fistula is frequent defecation. The stools may be described as watery, fatty, or enteric. Other symptoms may be belching of gas with fecal odor, or less frequently, fecal vomiting, marked and rapid loss of weight in spite of unimpaired or increased appetite and intake of food, dehydration, and loss of strength. Colicky lower abdominal or circumumbilical pains are frequently experienced. If the fistula is large, diarrheal movements occur soon after food is taken into the stomach; if the opening is small, and if it communicates with a distant segment of bowel, the cardinal symptoms are likely to be intermittent, for the fistula may close for a time and normal intestinal function ensue. With establishment of a fistula, pain often ceases. Abdominal palpation seldom if ever reveals a mass. If one is present, it is the result of extensive adhesions or regional inflammation. Because of the great variability in the physical signs, they are not reliable. The evolution of fistula is progressive and, unless surgical intervention is undertaken, the outcome is usually fatal.

In view of the fact that about 50 per cent of the patients who have jejunal ulcer detect symptoms within the first year, the length of time that elapses between the primary operation and that instituted for jejunal ulcer is surprising, especially when one considers that the discomfort is usually severe. In this regard Table V is of interest. When one considers each year individually, it is found that surgical intervention for jejunal ulcer is more frequent the second year after the primary operation, which is as one might expect. However, the average interval between primary and secondary operation for the entire group is 5.7 years.

#### TREATMENT

*Preventive.*—The most effective means of preventing jejunal ulceration after the surgical treatment of peptic ulcer is to avoid gastrojejunal anas-

TABLE V  
*Interval between Gastrojejunostomy and Operation for Jejunal Ulcer*

Interval, Years	Gastrojejunostomy Performed				Total	
	At Clinic		Elsewhere			
	Cases	Per Cent	Cases	Per Cent	Cases	Per Cent
0 to 1.....	27	9.9	20	6.4	47	8.0
1 to 2.....	44	16.2	46	14.7	90	15.4
2 to 3.....	41	15.0	40	12.8	81	13.8
3 to 4.....	25	9.2	25	8.0	50	8.5
4 to 5.....	22	8.1	32	10.2	54	9.2
5 to 6.....	19	7.0	26	8.3	45	7.7
6 to 7.....	18	6.6	29	9.3	47	8.0
7 to 8.....	12	4.4	14	4.5	26	4.4
8 to 9.....	14	5.1	13	4.1	27	4.6
9 to 10.....	14	5.1	15	4.8	29	5.0
10 to 15.....	28	10.1	40	12.8	68	11.6
15+.....	9	3.3	13	4.1	22	3.8
Total .....	273	100.0	313	100.0	586	100.0
Average .....	5.3 years		5.8 years		5.7 years	

tomosis in cases in which gastric acids are high and little or no pyloric obstruction exists. We now know that jejunal ulcer is likely to occur in individuals of this type, particularly if they are young and of a nervous, high-strung temperament. Consequently, if surgical treatment of a peptic lesion becomes necessary in such cases, it is preferable to carry out some form of local operation on the duodenum and maintain normal gastro-intestinal continuity whenever it can be done. For this purpose, excellent results have been obtained from excision of the lesion, together with the anterior two-thirds of the pyloric sphincter muscle, with closure as a gastroduodenostomy. This procedure can be used not only in cases of duodenal ulcer, but also in those of gastric ulcer situated near the pylorus. In cases in which it is not advisable to disturb the primary ulcer, the lower end of the stomach may be anastomosed to the first portion of the duodenum, as a lateral gastroduodenostomy. This operation is completed just as one would perform gastrojejunostomy without clamps. All of these patients should be impressed with the need of adhering to a regulated diet. A study of the trend of surgery at the clinic during the last ten years revealed more than a 100 per cent increase in the number of operations that maintained the more normal gastric physiologic action. On the other hand, it is not always possible or desirable to perform a local operation on the duodenum because of the type of the lesion or the presence of complicating factors.

The value of any surgical procedure depends on the safety with which it can be performed and the relief to be anticipated. Consequently, gastrojejunostomy still constitutes an excellent form of treatment for peptic ulcer



in some instances, for not only is the mortality low, but there is also an excellent chance of cure, as 86 to 88 per cent of the patients so treated obtain satisfactory results. However, there is some difference of opinion as to the relative merits of the anterior and the posterior methods of approach. We have always been partial to posterior gastrojejunostomy, but we do not hesitate to perform the anterior operation if technical difficulties are encountered that make the latter procedure more desirable. From the standpoint of jejunal ulceration, there seems to be little choice between the two operations. The higher incidence of jejunal ulcer following anterior gastrojejunostomy reported by some can probably be accounted for by the frequency with which entero-anastomosis is combined with that procedure.

One is immediately impressed by the small number of jejunal ulcers that develop after partial gastrectomy. This, however, is easily explained by the fact that this procedure was used infrequently, especially in the treatment of duodenal ulcer. The immediate mortality with partial gastrectomy, even in the hands of the most skilled surgeons, is variously stated as being between 5 and 8 per cent, whereas that for gastrojejunostomy usually averages less than 2 per cent; there is ample justification, therefore, for the employment of gastrojejunostomy in the treatment of peptic ulcer.

*Medical.*—There is still some diversity of opinion as to the advisability of instituting medical treatment in cases of jejunal ulcer. Unless emergency measures are required, considerable benefit may be derived from a supervised medical and dietary regimen, especially when the lesion is a jejunitis and not a true ulceration. We have been impressed with the excellent results which have seemed to come from the supplementary use of duodenal extract. On this account, we feel that it should be given a trial not only in cases of primary peptic ulcer, but also in those cases in which individuals are so unfortunate as to have a jejunal lesion subsequently, especially if the suffering is not too severe and prompt improvement ensues. The product was investigated experimentally by Ivy.<sup>6</sup> At the clinic, Rivers<sup>15</sup> has used the extract as supplementary treatment in more than 50 cases since October, 1934; however, a sufficient period has not elapsed to be sure of the permanency of the results. In some instances complete remission of symptoms has followed employment of 60 to 90 grains (4 to 6 Gm.) of duodenal extract for varying periods of eight days to four weeks, and when roentgenologic investigation of the digestive tract was made subsequently, all roentgenologic signs of the ulcer had disappeared.

The medical management of jejunal ulcer should be undertaken only when there is an opportunity to begin the treatment while the lesion is in an early stage. In some of these cases, a carefully supervised and regulated regimen will not only keep the patient comfortable, but it will eventually permit him to gain control of the condition. In view of the known tendency of jejunal ulcer to be accompanied by serious complications, considerable responsibility is assumed by anyone who persists in treating jejunal ulcers by medical measures regardless of unsatisfactory results. Such a plan very often permits

grave complications to develop, which materially increase the risk of treatment when surgical intervention finally becomes imperative. The patient's delay in seeking advice is another factor contributing to that situation; often he waits until there is a great deal of inflammatory reaction about the ulcer or even until a colic fistula has developed.

*Choice of Operation for Jejunal Ulcer.*—Secondary operation in a given case must necessarily depend to a large extent on the nature of the primary procedure. The development of a jejunal ulcer suggests that the patient probably will not show a greater degree of toleration to another anastomosis between stomach and jejunum, and that when a new relationship is effected, it should reestablish the normal continuity as nearly as possible. One should approach the problem with an open mind and be prepared to perform the operation that seems most feasible.

If the primary ulcer in the stomach or duodenum has healed and the pylorus is unobstructed, the most judicious procedure may be to disconnect the gastrojejunal anastomosis and excise the jejunal ulcer.

In other cases of jejunal ulcer following gastrojejunostomy, we feel that one of the following operative procedures may solve the problem: (1) Disconnection of the gastrojejunal anastomosis, resection of the jejunal ulcer, and pyloroplasty or gastroduodenostomy; (2) disconnection of the gastrojejunal anastomosis, excision of the jejunal ulcer, and gastric resection according to the Billroth I method, and (3) gastric resection at the level of the previous gastrojejunal anastomosis with a Pólya type of reconstruction. But, if the jejunal ulcer has followed primary gastric resection of the Billroth II type, it may prove feasible and satisfactory to disconnect the gastrojejunal anastomosis, excise the ulcer, and reconstruct by the Billroth I method.

Although we prefer to carry out one of the more conservative operations whenever possible, in some cases the situation of the jejunal ulcer is such that partial gastrectomy is the only procedure by which the disease can be eliminated. The operation will afford satisfactory relief in a high percentage of cases, but it must be remembered that the mortality will be high because of the poor general condition of patients with jejunal ulcer. The risk of resection of the stomach for peptic ulcer is certainly greater than that entailed in the more conservative procedures. However, resection of the stomach in cases of jejunal ulcer will be attended by only a slightly higher risk than is assumed in carrying out less radical operations, such as excision and reconstruction.

Jejunostomy can also be used to advantage either alone or in conjunction with any of the other procedures, and if the patient's condition is such that an extensive operation is contra-indicated or can be undertaken only at considerable risk, simple jejunostomy may place the upper portion of the gastrointestinal tract at complete rest for a sufficient period to permit the acute

# JEJUNAL ULCER

phase of the disease to subside. This added precaution was deemed advisable in 19 of the 597 cases in our study.

The surgical treatment of jejunal ulcer often presents many technical difficulties which entail precise judgment in the selection of the proper procedure and exacting skill in its performance. Consequently, it is impossible to employ a standard technic in all cases. This is well illustrated by the variety of methods utilized in the treatment of the 596 patients with benign lesions (Table VI).

TABLE VI  
*Type of Operation for Jejunal Ulcer*

	Cases	Per Cent
Excision of ulcer and reconstruction of gastrojejunal anastomosis. .	59	9.9
Disconnection of old gastrojejunal anastomosis and making a new one. . . . .	44	7.4
Excision of ulcer and disconnection of gastrojejunal anastomosis. . .	152	25.5
Pyloroplasty and disconnection of gastrojejunal anastomosis. . . . .	118	19.8
Billroth I and disconnection of gastrojejunal anastomosis. . . . .	4	0.7
Posterior Pólya and disconnection of gastrojejunal anastomosis. . .	167	28.0
Anterior Pólya and disconnection of gastrojejunal anastomosis; entero-anastomosis. . . . .	33	5.5
Anterior Billroth II, with entero-anastomosis. . . . .	6	1.0
Resection, and new anterior or posterior Pólya. . . . .	7	1.2
Closure of perforated jejunal ulcer. . . . .	4	0.7
Jejunostomy alone. . . . .	2	0.3
Total. . . . .	596*	100.0

\* Case of carcinoma of stomach not included.

A person who develops a jejunal ulcer should always be considered as having a definite ulcer forming potentiality, and he should not be dismissed by his physician until more is known about the etiology of primary and secondary ulcer. We routinely advise those under our care to return promptly for consultation if any gastro-intestinal difficulty arises. This plan offers the best opportunity to avoid further serious complications. A well directed course of treatment will often effect a cure.

## COMMENT

Satisfactory results are usually obtained in cases in which the proper operation has been performed for chronic gastric and duodenal ulcer. There is considerable variation in the statistics regarding the results of surgical treatment. This is the outcome of having no standard by which the judgment and skill of the different individuals can be measured. Occasionally, failure to obtain complete relief following operation on the stomach or duodenum may be due purely to functional disorders. However, before such

a conclusion is justified, the possibility of mechanical or organic factors must be entirely eliminated.

When jejunal ulcer is known to exist, anyone who persists in treating the lesion by medical management for a prolonged period assumes a great responsibility in view of the complications that may develop. The results of treatment of the 597 patients comprising this study illustrate the value of surgical measures in cases of jejunal ulcer, for secondary procedures were required in only 6 per cent of the traced cases.

The development of a jejunal ulcer suggests that the patient probably will not show a greater degree of toleration to another anastomosis between the stomach and jejunum, therefore a radical change in the gastro-intestinal relationship is indicated and, when this is established, it must maintain the normal continuity as nearly as possible. Undoubtedly the Billroth I operation will be used more often in the future as it really offers the ideal solution to the problem. It may be difficult to perform in some cases in which a considerable portion of the stomach has been removed at the primary operation; however, if the procedure can be employed, the continuity of the gastro-intestinal tract will be established in a better way than it would be by a Pólya operation.

#### SUMMARY

The incidence of jejunal ulcer following gastrojejunostomy for duodenal ulcer is about 2.8 per cent. It might be said that statistical data will not show the true incidence of jejunal ulcer, for figures are based on the patients who underwent the primary operation for peptic ulcer at the clinic and have returned later with jejunal ulcers. However, if cases which could not be traced were included in the series studied, there would be very little change in the percentages, for there are comparatively few patients who have not reported to us when symptoms of jejunal ulcer developed.

In only one case in this series was a jejunal ulcer found subsequent to a gastro-intestinal anastomosis made on account of a malignant lesion in the stomach. In this case the primary operation was a gastric resection.

The highest incidence of jejunal ulcer occurs during the third and fourth decades of life. The ratio of males to females in our series was 12.9 to 1.

Although jejunal ulcer occurs less frequently after partial gastrectomy, the operative mortality in such a procedure, when used routinely, will more than offset the increased liability to recurrent ulceration after conservative operations.

In approximately 50 per cent of the cases, symptoms of jejunal ulcer occurred within one year after the primary operation. The longest period elapsing between the primary operation and the return of symptoms was 19 years.

The characteristics of jejunal ulcer are quite similar to those of peptic ulcer. The tendency toward perforation is quite common, for it was mani-

fest in 43 per cent of the series of 597 cases. Gastrojejunocolic fistula was present in 8.7 per cent of the cases.

Medical management of jejunal ulcer should be undertaken only when there is an opportunity to begin treatment while the lesion is in an early stage. Not infrequently a carefully supervised regimen will not only keep the patient comfortable, but it will eventually permit him to gain control of the condition.

The logical surgical treatment of jejunal ulcer is to take down the gastro-jejunal anastomosis and restore normal gastro-intestinal continuity. If necessary, this procedure may be combined with some form of local operation on the duodenum and pylorus. However, in some cases partial gastrectomy may be indicated.

Only 6 per cent of the 597 patients traced required a secondary operation for jejunal ulcer, regardless of the variations in the nature and extent of the primary surgical treatment of the jejunal lesion.

Finally, a person in whom jejunal ulcer develops very likely has a high ulcer-potentiality, and it should be emphasized that an important part of the treatment is to advise the patient to adhere to a regulated diet indefinitely and to return at intervals for a review of his condition.

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## CARCINOMA OF THE JEJUNUM\*

REPORT OF THREE CASES

R. FRANKLIN CARTER, M.D.

NEW YORK

A SURGICAL review of the treatment of carcinoma of the jejunum is justified by the type of high intestinal obstruction encountered in such cases. Clark, in 1926, found that an early diagnosis of carcinoma of the small intestine had not been made in any of the cases reported up to that time. A review of 30 case reports of carcinoma of the jejunum in the past eight years shows that 72 per cent of the growths have caused an obstruction in the first 12 inches of the jejunum (Fig. 1). An obstructing growth in this region has been successfully treated by the method of resection and anastomosis to be described.

The material for this paper consists of the reports on three cases, operated on respectively by Drs. Edward Peterson, Thomas H. Russell and the author. The case reports of 30 cases that have appeared in the literature since 1927 when Hellstrom brought the subject up to date have been studied as a whole, as have those of Rankin and Raiford.

*Occurrence of Small Intestinal Tumors.*—Malignant tumors of the small intestine according to Ewing comprise approximately 3 per cent of all of those occurring in the gastro-intestinal tract. In 1932 Raiford collected from the literature 339 tumors of the small intestine and reported 88 cases in 56,500 surgical and autopsy specimens from the Johns Hopkins Hospital, the malignant tumors included three surgical cases of jejunal carcinoma. Bland Sutton in 1914 called attention to the frequent occurrence of tumors in the proximal jejunum and distal ileum. The report of 70 surgical cases of jejunal and ileal carcinoma collected from the literature by Hellstrom in 1927 gives the tumors in the jejunum less frequently than in the ileum. Rankin found a surprising number of jejunal cases to be near the ligament of Treitz in a report of 55 cases of small intestinal tumors from the Mayo Clinic, of which 21 were in the jejunum and 14 in the ileum. The relative percentage of malignant jejunal tumors is approximately 1 per cent of all of those occurring in the gastro-intestinal tract.

*Pathology.*—The types of growth, from the surgical viewpoint, are two: The majority are annular constricting adenocarcinomata that resemble growths of the sigmoid; and the polypoid tumors that grow into the lumen of the gut and frequently cause an intussusception, the polypoid type were encountered twice in the last 30 case reports. Secondary growths from other regions are mainly from carcinoma of the ovary and involvement by extension from the stomach and colon. In 75 per cent enlarged mesenteric nodes were present

\* Read before the New York Surgical Society, April 10, 1935.

at the time of operation. A further enlargement of the retroperitoneal nodes at the origin of the superior mesenteric artery does not necessarily mean malignant extension nor do they preclude the advisability of radical resection as the nodes may be inflammatory. Perforation of the growth with peritonitis has been reported in one surgical instance since 1927, and autopsy reports of this complication are unusual.

*Symptoms and Diagnosis.*—There are no specific symptoms of cancer in the jejunum. In the early stage of the growth there are usually no subjective symptoms other than anemia and asthenia. The annular type of growth produces symptoms of increasing intestinal occlusion with repeated attacks of vomiting of an obstructive type. In the case reports of the last 40 cases

the majority were operated upon with symptoms of from four to six months' duration. In the annular type the symptoms varied from one month to three years and four cases were operated upon in an attack of acute intestinal obstruction. In the series of 21 cases from the Mayo Clinic the average duration of symptoms was 14 to 15 months. The polypoid growths with acute intussusception and acute obstruction occur more often in the lower jejunum and ileum.

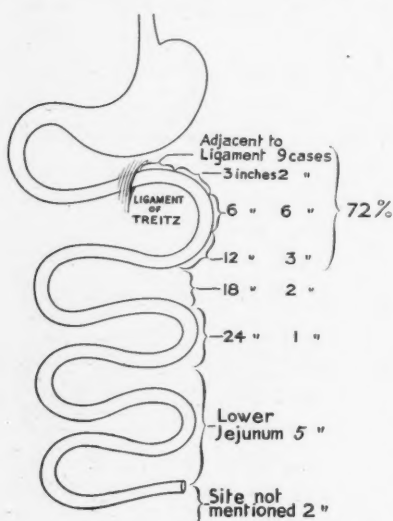
Vomiting is the most characteristic symptom and it was present in 28 of 30 cases reported since 1927. The vomiting of large amounts of grayish green liquid containing particles of undigested food is typical for obstruction near the ligament of Treitz. The character of the vomitus

FIG. 1.—A schematic representation of the location of growths in the last 30 case reports appearing in the literature.

is misleading in that it does not resemble fecal vomiting and therefore the severity of the obstruction may not be suspected from this symptom alone as would be the case in fecal vomiting.

Pain is not a symptom of frequent occurrence in the case reports of growths at or near the ligament of Treitz. Distention of the duodenum and first portion of the jejunum occurs without producing the characteristic colicky pain complained of in obstruction from growth in the ileum and colon. Epigastric distress from distention is relieved by vomiting and in one instance induced vomiting to relieve distress has been reported. Steady pain in the epigastrium is a late symptom and probably results from metastasis to retroperitoneal nodes. Penetration by the growths is rare and there has been no case report found giving the type of pain that occurs in gastrojejunal ulcer.

Visible peristalsis has been reported to be present only when the growth was present in the lower jejunum. Objective abdominal distention is absent or not noticeable in growths in the proximal jejunum. Obstipation and



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gradually increasing constipation have been emphasized by writers on the subject of cancer of the small bowel but they are not so frequently reported in cases of growths in the jejunum.

Loss of weight is a striking symptom and amounts varying from five to 40 pounds are reported. This was an important finding noted in 28 of the last 30 cases reported.

Annular growths in the jejunum do not usually pass through an ulcerating stage so that hemorrhage is rarely encountered; one instance was reported in 30 cases. As the polypoid growths tend to grow into the lumen of the gut, a large mass rarely forms before obstruction occurs and the palpation of an abdominal mass is usually not possible until after metastasis takes place.

The roentgenographic diagnosis of carcinoma of the jejunum depends upon the presence of obstruction. This portion of the intestinal tract does not lend itself to roentgenographic study as does the pylorus and duodenum. In 30 case reports a roentgenogram was taken in 23 with the diagnosis of obstruction in the jejunum in 19, a duodenal ulcer in one and as negative in three. The roentgenograms in Case I (Fig. 2), are typical of those appearing in various case reports as characteristic for obstruction of the jejunum by cancer. No case report has been found in which



FIG. 2.—Case I: Roentgenogram showing obstruction in the first portion of the jejunum.

roentgenographic diagnosis of cancer of the jejunum was made before obstruction took place. An improved technic for the roentgenographic study of the jejunum seems to offer the only chance for an early diagnosis of tumors in this region.

*Treatment.*—Every phase of the subject has been adequately treated in the literature by Raiford, Rankin, Clark, Hellstrom and Hinz except that of treatment. The usual short paragraph devoted to treatment recommends excision where possible with an end-to-end or side-to-side anastomosis depending upon the condition found at the time of operation. If inoperable, sidetracking operations are advised. No well-devised plan has been advocated for the treatment of these cases of obstruction.

As patients with jejunal occlusion by cancer are gradually subjected to intestinal obstruction, they become accustomed to the changes in metabolism. A somewhat similar condition in hypertrophic stenosis of the pylorus has shown the value of adequate preoperative preparation in the lowering of opera-

tive mortality. It is just as important to adequately prepare patients with obstruction in the jejunum, and sufficient time for this preparation should be taken in all except the cases of perforation with peritonitis.

A chemical blood determination of the urea, sugar, chlorides and  $\text{CO}_2$  combining power is important in determining the extent of alkalosis in these patients. The preoperative administration of 3,000 to 4,000 cc. of fluid with 400 Gm. of glucose and 30 to 40 Gm. of sodium chloride is indicated in every case of high intestinal obstruction that does not show signs of sepsis by a high fever, pulse or other signs of shock. In severe or protracted cases two or three days of medical treatment are permissible and advisable rather than emergency operation.

Frequent lavage or continuous intubation with the Levine tube during the preoperative period is an advantage in draining the proximal segment of duodenum and jejunum. A safe rule to follow would be to prepare for operation all patients with an incontinence temperature by a daily routine of intravenous or subcutaneous administration of fluid, glucose and chloride, until the temperature does not rise above  $100^\circ \text{F}$ .

General anesthesia with ether is preferable for complete relaxation and it will be well borne by patients who have had adequate preoperative preparation.

*Operative Procedure.*—Resection of the growth and removal of metastases should be the aim in operating upon these patients. As in carcinoma of the sigmoid, the growths in the jejunum tend to metastasize to regional lymph nodes and distant metastases are late in occurring. Inoperable retroperitoneal lymph nodes should not be taken as a sign of inoperability as they may be inflammatory and a sidetracking operation entails about the same amount of surgery as removal and anastomosis.

At the ligament of Treitz and within 12 inches below there arises the necessity for particular consideration in performing an anastomosis after excision of the segment of the gut containing the growth. The edema, hypertrophy and dilatation of the gut proximal to the growth make an end-to-end anastomosis in this region difficult. The disproportion in the caliber of the two segments, rapid peristalsis in this region and the shrinkage of the proximal segment after operation all tend to increase the danger of leakage of the suture line. Under these conditions a side-to-side union is the operation of choice. Due to the proximity of the ligament of Treitz there may not be sufficient jejunum below this point after excision of the tumor to allow for a side-to-side anastomosis.

During the resection of the growth in Case I Dr. Thomas H. Russell advised that an end-to-end anastomosis by him under similar conditions in two cases had been followed by leakage with peritonitis and death. In casting around for another method the bulging of the third portion of the duodenum to the right of the ligament of Treitz was noted (Fig. 3). Following Doctor Russell's advice the end-to-end anastomosis method was discarded and duodenojejunosomy was decided upon. The proximal jejunum was inverted



# CARCINOMA OF THE JEJUNUM

and buried very similar to the method in common use for the duodenum in the Pólya partial gastrectomy. The anterior leaf of the transverse mesocolon

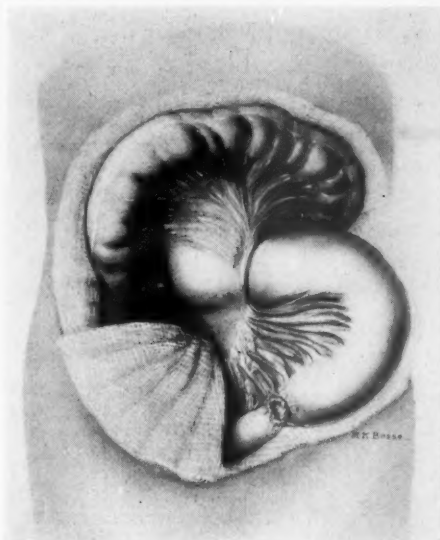


FIG. 3.—Appearance of growth and dilated jejunum and duodenum in Case 1.

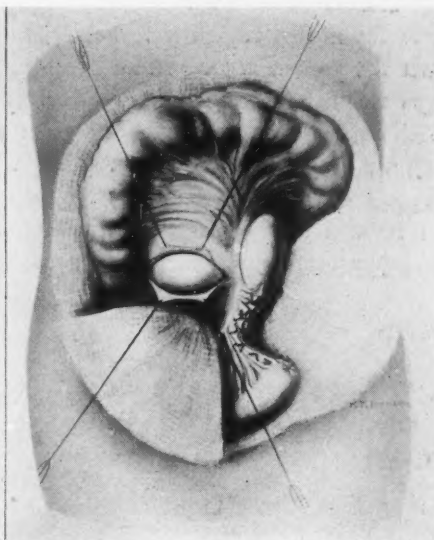


FIG. 4.—Resection of the portion of the jejunum containing the growth and opening in transverse mesocolon. The wall of the duodenum was drawn through the slit (Fig. 5).

was incised as for a gastrojejunostomy (Fig. 4). The distal jejunum was swung to the right, contraclockwise, to lie by the distended duodenum. A

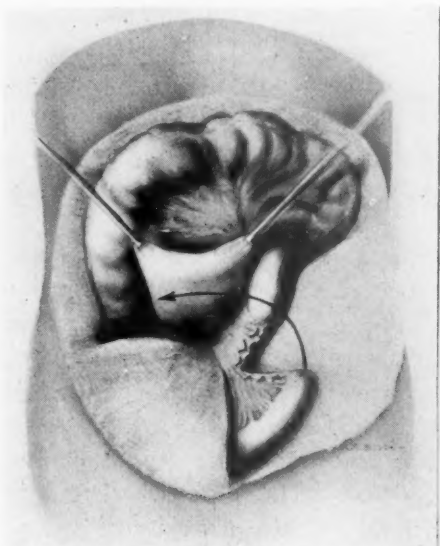


FIG. 5.—Duodenum drawn through and prepared for anastomosis.

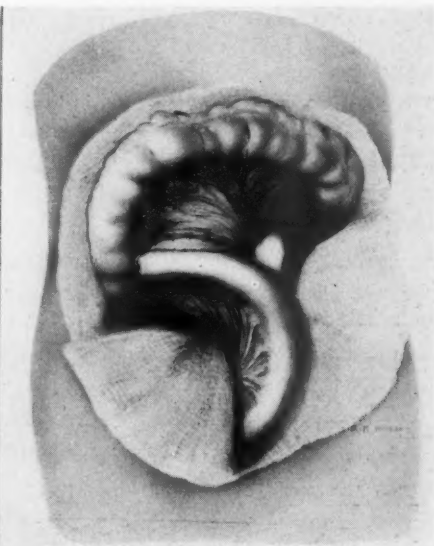


FIG. 6.—Anastomosis between the distal jejunum and third portion of duodenum.

side-to-side anastomosis was performed in the usual manner. The upper edge of the slit in the mesocolon was sewn to the duodenum anteriorly. The

mesentery of the distal jejunum along its cut border was stitched to the peritoneum of the posterior abdominal wall (Fig. 6).

The previous operations reported in the literature as being used for growths in this region have been gastro-enterostomy by Bevan who reported that the patient recovered and remained comfortable so long as the stomach was washed thoroughly every day. An end-to-end anastomosis by various authors has been used with a high mortality. An end-to-side, duodenum to jejunum, by Lundberg who reports a successful case with the method. Resection of the growth at the ligament of Treitz with a gastro-enterostomy performed with the distal segment necessitates the regurgitation of the bile and pancreatic juice into the stomach. This reverse peristalsis is sufficient to cause nausea or a distinct discomfort to the patient.

For patients with inoperable growths in this region the operation as recommended by Rankin of duodenojejunosomy is recommended.

Immediately following the anastomosis a Levine tube should be introduced from the stomach into the jejunum. This will insure drainage of the duodenum into the jejunum.

The postoperative behavior of the blind end of the jejunum in Case I, shows that this segment together with the duodenum has returned to normal caliber and, while a small amount of barium is seen in the blind end, the major portion of the meal finds its



FIG. 7.—Appearance of roentgenogram in Case I one year following operation.

way through the new opening. There is some evidence in the picture of lakeing at the site of anastomosis which has caused no subjective symptoms so far (Fig. 7).

The report of the successful outcome in a method employed on one occasion would not be justified under different conditions. The method described is reported at this time because of the rare occurrence of growths in this region and, while a similar use of this method has not been found in the literature, the basic principle of the anastomosis has been shown to be sound when used for other more common conditions.

*Prognosis.*—In the 70 cases studied by Hellstrom there were 47 cases of resection with a primary mortality of 43.5 per cent. Thus radical resection was possible in 67 per cent of cases with an operative mortality of 36.2 per cent. The follow up results in the cases in Hellstrom's series shows a definite cure in 16 per cent. In Rankin's report of 21 cases from the Mayo Clinic the prognosis was poor regardless of the surgical procedure, no patient lived

longer than three years after operation and the average was less than one year. In the reports of 30 cases since 1927, exclusive of Rankin's and Raiford's series, there have been 24 cases of radical resection, or 80 per cent, and six cases with inoperable conditions for which side tracking operations were performed in five and an abdominal exploration in one. Of the 24 cases of radical resection 16 recovered from operation with an operative mortality of 43.4 per cent. The method of end-to-end anastomosis resulted in recovery in nine cases and death in six. The six cases with side-to-side anastomosis all recovered. In four cases in which the type of anastomosis after resection was not specified there were two deaths and two recoveries.

The follow up record of the 30 case reports is incomplete, one case is reported alive and well after five years, one after 26 months, two after one year, one after six months and one death from recurrence after three years.

The experience with the three cases reported at this time is: All had glandular metastases at the time of operation; two were resected with one end-to-end anastomosis and one side-to-side; one inoperable in which a side-to-side union was done with operative recovery and death six weeks later from cachexia. The patient that recovered following radical excision in which the enlarged nodes showed no cancerous involvement, is alive and well 14 months after operation.

#### CASE REPORTS

CASE I.—F. D., female, white, age 59. Admitted to the Post Graduate Hospital February 23, 1934.

*Past History.*—Always in good health with the exception of phlebitis of leg 35 years before, following birth of child. Tonsillectomy, seven years previously followed by erysipelis of the face.

*Present History.*—Chief complaint of intermittent attacks of vomiting for two years accompanied by mild epigastric pain. The attacks have lasted for one to two days and were followed by a period of freedom from all symptoms. Constipation has been chronic. For one week prior to admission vomiting has been continuous. Loss of weight of 12 pounds in last few months.

*Physical Examination.*—Well nourished and not acutely ill. Abdomen moderately distended with no palpable masses and no visible peristalsis.

*Roentgenographic Diagnosis.*—Obstruction at fourth portion duodenum (Fig. 2).

*Preoperative Diagnosis.*—Carcinoma with obstruction of the duodenojejunal region.

*Operation.*—February 24, 1934. General anesthesia. *Findings.*—Annular carcinoma of the jejunum six inches below the ligament of Treitz with enlargement of the adjacent mesenteric nodes (Fig. 8). Dilatation, edema and hypertrophy of the proximal jejunum.

*Procedure.*—Resection of the jejunal segment and mesentery with duodenojejunostomy.

*Postoperative Course.*—Vomiting of large quantities of duodenal content for ten days after which no further vomiting occurred. Patient has gained 20 pounds in weight and has no gastro-intestinal symptoms at present. Roentgenograms taken one year after operation show the anastomosis functioning well with very slight tendency to dilatation and stasis at the point of anastomosis.

CASE II.—M. B. McC., female, white, aged 66. Admitted to St. Francis Hospital, June 4, 1930.

*Past History.*—Childhood diseases. Hysterectomy for uterine fibroids 16 years previously.

*Present History.*—Began with a fulness after meals, belching of gas and vomiting of six months' duration. Vomiting after every meal for three months. Loss of 30 pounds of weight. Constipation, severe. No pain.

*Physical Examination.*—Well nourished with no appearance of weight loss. Abdomen negative for mass, point of tenderness, rigidity or visible peristalsis.

*Preoperative Diagnosis.*—Pyloric obstruction.

*Operation.*—June 9, 1930, under spinal anesthesia. *Findings.*—Annular carcinoma of jejunum near the ligament of Treitz with enlargement of nodes of the adjacent mesentery. Marked distention and dilatation of the proximal jejunal segment.

*Procedure.*—Resection of the jejunum and mesentery with an end-to-end anastomosis. Patient did not react well from operation and death occurred two days later.

*Pathologic Report.*—Adenocarcinoma.

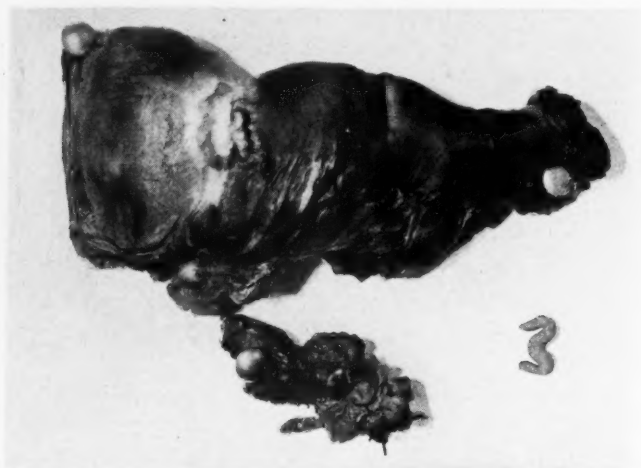


FIG. 8.—Appearance of growth and resected jejunum with retroperitoneal nodes that were removed.

CASE III.—L. S., male, colored, aged 46. Admitted to the Post Graduate Hospital in July, 1904.

*Past History.*—All diseases of childhood. Typhoid fever at five years of age, gonorrhea at 21 and possible chancre at 23.

*Present History.*—Began two years previously with gradual onset and increasing severity of gastric distress of distention with gas which was relieved by vomiting. Distress had enforced irregular eating with a loss of 40 pounds of weight in four months.

*Physical Examination.*—General appearance of loss of weight with weakness. The abdomen was scaphoid, tense, no masses felt and after taking water gastric peristalsis was visible.

*Preoperative Diagnosis.*—Pyloric obstruction.

*Operation.*—July 16, 1904, revealed a distended stomach and duodenum. A narrow fibrous annular stricture of the jejunum, 18 inches below the ligament of Treitz, was found with extensive lymph node enlargement in the adjoining mesentery and a large retroperitoneal mass.

*Procedure.*—A side-to-side anastomosis was performed by the elastic ligature method. Patient was discharged from the hospital one month later with symptoms of distress relieved. Death occurred six weeks later from cachexia.

## CARCINOMA OF THE JEJUNUM

*Pathologic Report.*—A node removed from the mesentery showed adenocarcinoma of the scirrhus type.

### CONCLUSIONS

(1) Carcinoma of the jejunum is rare; it represents approximately one per cent of all of the cases of carcinoma that occur in the gastro-intestinal tract.

(2) Approximately 72 per cent of growths occur in the first 12 inches of the jejunum.

(3) Polypoid growths with intussusception are rare in the jejunum.

(4) The diagnosis is dependent upon symptoms and signs of high intestinal obstruction.

(5) Preoperative preparation of the patient is of paramount importance in reducing operative mortality.

(6) Resection of the growth with side-to-side duodenojejunostomy is the procedure of choice in growths in the jejunum in the region of the ligament of Treitz.

*DISCUSSION.*—DR. PAUL K. SAUER (New York) stated that fortunately carcinoma of the small intestine is an infrequent occurrence, and that its diagnosis was most difficult, being made usually at operation. Not all portions of the intestinal canal are attacked with equal frequency, the incidence being in direct ratio to the distance from the stomach. Nothnagal, reporting on 1,100 cases, showed that only 2.5 per cent of carcinoma of the intestinal canal occurred in the small gut. De Bovis, who gathered the statistics of Maydl, Holsti, and Ruepp, reported 6.3 per cent in the jejunum and ileum; and G. Heimanns found 20 cases among 1,706 examinations of carcinoma of the intestinal canal, about 1.1 per cent.

The type most frequently found is the cylindrical cell adenocarcinoma. The medullary type is less frequent, and the gelatinous and scirrhus types are the least frequent in the order named. Anschütz first called attention to the fact that neoplasms of the small gut show a predilection for the first portion of the jejunum and the terminal portion of the ileum. Kanzler noted that 25 per cent of his cases occurred between the first and third decades.

The character of the vomitus is an important point in evaluating symptoms. If the vomitus is analyzed, free hydrochloric acid is noticeably absent, and the combined acid greatly reduced. Pain is usually absent and appears only very late as the result of metastases, or is due to severe obstruction.

The prognosis is always grave. Albrecht, in 1918, reported eight cases with a mortality of 100 per cent. Hellstrom's mortality is 79.7 per cent. In all probability most of these cases were operated upon as emergencies to relieve the obstruction. In those in which the diagnosis may be suspected, and the preoperative treatment as outlined by Carter carried out, the mortality will be much lowered.

### CASE REPORTS

*CASE I.*—M. B. (No. 27680). Female, aged 51, was admitted to the Lenox Hill Hospital, complaining of weakness and nervousness for six weeks, and of nausea and vomiting for ten months. There had been no pain and no melaena. Otherwise the history was not significant. She died on the sixth day after admission without a diagnosis having been made. The autopsy report showed: "A tumor at the duodenojejunal



juncture, polypoid in character, and almost occluding the lumen. The tumor is extensively ulcerated, of fairly soft consistency, deeply infiltrates the wall and encircles the entire lumen. The duodenum is greatly distended. Diagnosis: Carcinoma of the jejunum."

CASE II.—A. W. (No. 40449). Female, aged 37, was admitted to the Lenox Hill Hospital in a semicomatose condition. The history, obtained from her husband, revealed that the patient had not been well for the past two or three years, but the acute symptoms were severe pain in the right upper abdomen and vomiting of small amounts of fluids, which had been present for 12 days. The patient died on the day following admission, no diagnosis having been made. The autopsy report showed an intussusception of the jejunum, which had been reduced. A mass was found 65 cm. from the duodenojejunal junction. It was found to encircle the jejunum. There were numerous papillary growths. The mesenteric nodes were slightly enlarged. Diagnosis: Carcinoma of the jejunum.

DR. THOMAS H. RUSSELL (New York) said that the two cases, mentioned by Doctor Carter in his paper, were both women, both over 60 years of age, both completely obstructed, both had lost between 30 and 40 pounds in weight in the few weeks preceding operation, both presented a growth eight to ten inches from the ligament of Treitz, both showed symptoms of myocarditis before operation, both died a few days after operation, and both were adenocarcinomata completely encircling the jejunum.

When Doctor Russell in consultation with Doctor Carter saw the case since successfully operated on, he mentioned his experience with his own two cases and said that if diagnosis could be made he would operate in stages. However, Doctor Carter had worked out an idea of using preoperative treatment instead of a multiple stage operation, followed by resection of the growth and a side-to-side anastomosis utilizing the duodenum farther up in preference, for reasons of safety, rather than to anastomose to the dilated intestine immediately proximal to the duodenum. In one of his cases, Doctor Russell had resected the growth with an end-to-end anastomosis and jejunostomy proximal to the site of anastomosis. In the other, he had resected the growth with an end-to-end anastomosis and did a gastro-enterostomy, thinking that this might take the place of an enterostomy.

DOCTOR CARTER said that in reviewing all of the cases up to date he had been unable to distinguish well the exact site of the tumor in the earlier reports, but it was his impression that less than 100 cases of surgical carcinoma of the jejunum have been reported, though there were many more autopsy reports. In the latter, the incidence of carcinoma of the jejunum varies from 0 to 9 per cent, with 3 per cent a fair average.

## THE SURGICAL DIABETIC

A FIVE YEAR SURVEY

CHARLES M. LEVIN, M.D.

AND

FRANK N. DEALY, M.D.

JAMAICA, N. Y.

FROM THE SURGICAL SERVICES OF THE MARY IMMACULATE HOSPITAL, JAMAICA, N. Y.

THE fact that there are doubtless well over a million diabetics in the United States, the incidence of the disease being between one and two per cent of the population, and that, as Joslin says, every other diabetic is a surgical diabetic before he dies, indicates the importance of the consideration of this subject and justifies any effort toward analysis of our hospital work.

Diabetes is a common disease, becoming increasingly more so since the advent of insulin in 1922, paradoxical as such a statement as that seems. When we recall, however, that in the past, before the use of insulin, more than 80 per cent of patients with severe diabetes died within ten years and that children developing diabetes seldom lived more than six, it becomes evident that because of insulin, now promising practically a normal span of life for the diabetic, there are thousands of diabetics among the general population who would long since have died without it and that the more successful our treatment of diabetes becomes, short of any measure which may restore the affected pancreas to its full functional capacity, the greater will be the incidence of the disease.

Not only are more diabetics reaching adult life and more advanced years, but for the same reason more diabetics are constantly becoming surgical diabetics. This is not so much because of the existence of conditions commonly associated with diabetes, as because of the fact that diabetics now more frequently reach an age where surgical conditions common to that age develop. Insulin has made it possible for the diabetic to share with those not so afflicted the ailments common to all men and to all decades of life.

The modern medical mortality in diabetes has through insulin thus been markedly reduced, to as low as 1.7 per cent as reported by Joslin, and even here the deaths are due not to acidosis and coma, but to arteriosclerosis and cardiorenal disease.

It is admitted, however, that with the surgical diabetic, the picture abruptly changes and assumes a far more serious aspect. With a mortality of 11 per cent in a group of Joslin's surgical diabetics, it is at once apparent that the surgical diabetic is the serious diabetic and is six times as likely to die as the diabetic who has no surgical disease. But this mortality rate is one in an institution where the principles of the proper treatment of diabetes have long been recognized and scientifically practiced and by no means

represents the results which may be expected or even uniformly obtained in the average hospital.

With our scientific knowledge of the powers of insulin and the possibilities in the modern management of diabetes, we must nevertheless not be lulled into a sense of complete security, for the mortality rate in the surgical diabetic is still appalling and figures three times as high as Joslin's can readily be found in the literature and sometimes even on our own services.

It is well, therefore, to discount the comforting statements so frequently made that the diabetic is or can be made as fitting a subject for surgery as the nondiabetic and to keep firmly in mind that this is so only when every precaution is taken in the management of these cases. It is far safer still to consider the surgical diabetic essentially a bad surgical risk. The recognition of this fact is the first step in the proper handling of the case and whatever surgery is indicated, it will assure a routine, adequate and workable cooperation between internist and surgeon that will alone properly safeguard him.

Aside from the dangers, inherent in the diabetic, of an unbalanced metabolism, brought on through operation or the administration of an anesthetic, the lowered resistance to infection and the coexistence of arteriosclerosis are the two important factors which spell defeat for the surgical case. As M. J. Henry states, practically the only way in which the properly controlled diabetic patient differs from the nondiabetic one of similar age and physical condition is in his reaction to the presence of infection. Infection is a disruptive force to the diabetic. Whether this is due to lowered resistance of the sugar-laden tissues with impairment of normal cell proliferation or to a disturbance in metabolism from improper assimilation of carbohydrates, as Minkowski states, or to vascular deficiencies or to any of many other causes, the advent of infection is often quickly disastrous to the diabetic patient. Because of the polyuria and common dehydration with dryness of the skin, infection here can readily occur, as infectious processes can of course develop elsewhere, but having once taken hold, such a process disrupts the metabolic balance, tends to increase acidosis, makes the usual doses of insulin inadequate and unless promptly controlled surgically, can and frequently will prove to be a terminal factor in the disease.

To lose a patient from a cellulitis after he has successfully passed through both stages of a radical resection for carcinoma of the rectum, for instance, impresses one with the rôle that infection can play in the diabetic, but we see it still more frequently, of course, in infections such as carbuncles or in association with gangrene of the extremities, in which infection sweeps through the organism in a rapidly fatal septicemia. Besides this lowered resistance of the diabetic to infection, therefore, an additional factor which tends to make of the diabetic a poor surgical risk is the coexistence, in one form or another, of arteriosclerosis. It is stated that the diabetic is an arteriosclerotic if he has had the disease over five years and this involves not only the peripheral vessels with consequent impairment of circulation and increased susceptibility to gangrene, but the cerebral and coronary

vessels as well. Many a diabetic and practically all gallstone and gangrene cases, Joslin states, have perhaps an unsuspected coronary or cardiorenal disease and according to the extent and character of the underlying pathology, present that much more of a problem in the preoperative and postoperative care.

The surgical diabetic, moreover, is beset by still other difficulties which add to the hazards of operative therapy. Many have been depleted by a recent loss of weight, which in some instances is often marked. McKittrick and Root in 100 surgical diabetics found this to average 54 pounds, which is an obvious indication of the diminished vitality supporting these patients.

The relation of hyperthyroidism to diabetes is of considerable interest, about one per cent of the cases of hyperthyroidism being complicated by the coexistence of diabetes. The dietary control of such a case is obviously difficult, for regardless of the dietary restrictions, the hyperthyroidism causes, as Joslin so succinctly describes it, an "endogenous overeating," which only a thyroidectomy will correct, benefiting, in this way, not only the hyperthyroidism, but frequently the diabetes as well.

With an increased susceptibility to shock, intolerance to infection or trauma, diminished reparative powers, subject to the constant threat of acidosis, suffering from the effects of latent or actual arteriosclerotic changes, often peculiarly depleted from the effects of starvation, diarrhea or vomiting, with all the metabolic processes inordinately affected by fever or hyperthyroidism, the diabetic patient is truly one who presents a complex problem. That such a patient can successfully undergo operative procedures is a triumph for the modern management of these cases, but in spite of the justly confident statements in the literature regarding the possibilities of surgery in the diabetic, it is hazardous to lose sight of the fact that the diabetic is at least potentially a poor surgical risk and that success will be achieved only by an appreciation of the intricacies of the problem and painstaking care in their management.

The question of anesthesia also is of paramount importance in the diabetic but with the splendid development in this field during the past decade, the difficulties here have been largely overcome. Tissue-cell destruction from the toxic effect of anesthetics resulting in impairment of the glycogenic function of the liver must be avoided. For this reason chloroform is definitely contraindicated. Ether likewise causes a hyperglycemia even in normal patients, and moreover greatly inhibits the action of insulin, but with proper precautions is still frequently used with safety. Ethylene, giving greater relaxation than gas and oxygen, has many advocates and in conjunction with local infiltration of the abdominal wall is often ideal. It must be remembered, however, that local infiltration lowers the resistance of the injected tissues, even in normal individuals, particularly in the presence of inflammation. Local infiltration in infected areas should, therefore, be avoided.

Spinal anesthesia in the absence of conditions contraindicating its employment probably has its greatest field of usefulness in the diabetic, but in

the choice of any anesthetic, due consideration should always be given to the underlying complications, the presence or absence of infection, the cardiovascular reserve, as well as to the probable effects upon metabolism itself. Postoperative vomiting and its resulting dehydration and possible acidosis or alkalosis should be avoided.

In discussing the types of surgical conditions met with in diabetics, we find that they are usually considered as falling into two main groups:

(1) Those which are held to be true complications of the disease itself, such as infections of the extremities, cellulitis, carbuncles or gangrene; a group in which the predominating mortality lies.

(2) Those which are merely coincident to the diabetes, having no causal relationship to that disease, but met commonly among all classes of patients, especially in the fifth, sixth and seventh decades of life. Here the mortality parallels more closely that of similar conditions found among nondiabetics.

In our study of the surgical diabetics treated at the Mary Immaculate Hospital during the five year period from 1930 to 1935, however, we found the following classification to be of greater assistance to us as it enabled us more clearly to define the standards of treatment for each group:

(1) Urgent cases, such as acute appendicitis, perforated ulcers or acute intestinal obstruction, which tolerate no delay but demand immediate operation.

(2) Essential cases, such as certain infections, many cases of gangrene and other conditions in which, while a prompt resort to surgery is demanded,

TABLE I

*Analysis of Cases*

Number of surgical diabetics admitted.....	136
Males.....	47
Females.....	89

*Age of patients by decades*

Years	Cases
1-9.....	0
10-19.....	1
20-29.....	0
30-39.....	9
40-49.....	17
50-59.....	43
60-69.....	46
70-79.....	19
80-89.....	1

Youngest, 14 years of age; oldest, 80 years of age

*Period of Hospitalization*

From 1 to 106 days; average, 23.9 days

Number of patients with acidosis on admission.....	44
Total number of deaths.....	37 or 27.2 per cent
Number of patients operated upon.....	108
Deaths in operative cases.....	27 or 25 per cent



# THE SURGICAL DIABETIC

operation is not necessarily immediate, but may be deferred for a brief space of time in which some effort may be made to stabilize the patient.

(3) Elective cases, such as most gallbladders or uncomplicated herniae, in which, though surgery is more or less strongly indicated, it is not essential to the immediate preservation of life.

In analyzing this series of cases, we have prepared the following tables which indicate briefly the work covered.

TABLE I indicates the number of surgical diabetics admitted during this period, their ages, period of hospitalization, *etc.*, as well as the general and postoperative mortality.

TABLE II lists the various types of surgical conditions present among these diabetics with the mortality rate in each. This, of course, is of little importance in a small series such as this, except in those cases of carbuncles, infections of extremities and gangrene in which the mortality, as in other series, is so strikingly high.

TABLE II  
*Surgical Conditions Encountered*

	Cases	Deaths	Mortal- ity
Appendicitis.....	12	2	16.8
Gallbladder disease.....	5	1	20
Fibroma of uterus.....	2	0	0
Prostatic hypertrophy.....	1	1	100
Fractures.....	13	1	0.7
Perforated peptic ulcers.....	2	2	100
Herniae.....	3	0	0
with intestinal obstruction.....	3	2	66.6
Carbuncles.....	10	3	30
Infections of extremities.....	25	5	20
Hyperthyroidism.....	1	0	0
Empyema.....	1	0	0
Gangrene.....	44	20	45.4
Miscellaneous.....	14	0	0
	136	37	27.2%

TABLE III  
*Operations Performed*

(1) <i>Urgent</i>	Opera- tions	Deaths	Mortal- ity
Appendicitis.....	11	2	
Strangulated hernia.....	3	2	
Intestinal obstruction (internal).....	1	0	
Perforated peptic ulcer.....	2	2	
Acute suppurative cholecystitis.....	1	0	
	18	6	33.3%

	Opera- tions	Deaths	Mortal- ity
(2) <i>Essential</i>			
Ischiorectal abscess.....	1	0	
Fractures and dislocations.....	7	0	
Infections of extremities.....	25	5	
Carbuncles.....	10	3	
Iridectomy (glaucoma).....	1	0	
Suppurative mastitis.....	2	0	
Amputation of leg for gangrene.....	1	0	
Amputation of thigh for gangrene.....	24	12	
Multiple abscesses (septicemia).....	1	1	
	72	21	29.1%
(3) <i>Elective</i>			
Herniae.....	3	0	
Appendicitis (interval).....	3	0	
Submucous resection.....	1	0	
Cataract.....	1	0	
Hemorrhoidectomy.....	1	0	
Tonsillectomy.....	1	0	
Cholecystectomy.....	1	0	
Retroversion and perineal repair.....	2	0	
Endometritis (D. and C.).....	1	0	
Cervical polyp.....	1	0	
Hysterectomy.....	2	0	
Thyroidectomy (hyperthyroidism).....	1	0	
	18	0	0
Total operations.....	108	27	25%

In TABLE III we have presented those cases in which operations were performed. There were 108 patients among the 136 admissions who were operated upon. The mortality is seen to be greatest, of course, among the urgent cases, due to the nature of the surgical conditions present, but is also formidable in the "essential" group in which operation, while not immediate, was usually promptly done with only slight delay for a brief period of preparation. The mortality here was made up almost exclusively among carbuncles, infections and thigh amputations for gangrene, being 30, 20 and 50 per cent, respectively, showing the toll that those types of cases exact. Among the elective group, there was no mortality, although one patient who had had a hysterectomy later entered the hospital with gangrene of an extremity and died following the amputation of the thigh.

In studying the causes of death as shown in TABLE V, it was found that sepsis, and next in importance, arteriosclerotic heart disease, were responsible in the vast majority of cases. It is apparent, therefore, that excluding the surgical conditions which in themselves proved fatal, even in the acute cases, it was not the diabetes itself which killed these patients, but rather the complications of diabetes—lowered resistance to infection and arteriosclerotic changes—which made it impossible for them to respond successfully to the usual surgical measures.

# THE SURGICAL DIABETIC

TABLE IV

## Anesthetics

	Cases	Deaths
Gas-oxygen.....	36	8
Gas-oxygen-ether.....	15	1
Ethylene.....	21	5
Spinal.....	24	10
Avertine.....	2	0
Local.....	7	1
Local-gas-oxygen.....	1	1
	<hr/> 106	<hr/> 26

In two patients, no anesthetic was employed, the operative procedure in one being the reduction of a dislocation under morphine; the other, with a fatal outcome, being multiple incisions in a case of sepsis.

TABLE V

## Analysis of Deaths

Total Number of Deaths.....	37 or 27.2%
Died without operation.....	11
Postoperative deaths.....	26

## Diagnosis in Fatal Cases

Appendicitis.....	2
Cholecystitis (no operation).....	1
Prostatic hypertrophy.....	1
Fracture of femur (no operation).....	1
Perforated peptic ulcer.....	2
Hernia (strangulated).....	2
Carbuncles.....	3
Infections.....	5
Gangrene (no operation).....	8
Gangrene (with amputation of thigh).....	12
	<hr/> 37

## Causes of Death

Sepsis.....	19
Arteriosclerotic heart disease.....	14
Pneumonia.....	3
Coma.....	1
	<hr/> 37

Only one patient died from acidosis, that patient entering the hospital unconscious and dying two hours after admission.

The cases of gangrene are indeed a serious problem. It is easy to excuse a fatality in any individual case, for each case presents so many factors which make surgery hazardous, but when one contemplates the results in the aggregate, in a series of cases, such as that analyzed in this five year survey, he cannot fail to be deeply impressed by the fatalities which occur and to be moved by the desire to prevent them.

TABLE VI  
*Gangrene Cases*

<i>Patients Admitted with Gangrene</i> .....	44
Recoveries .....	21
Signed release (no operation) .....	3
Total deaths .....	20 or 45.4%
Died without operation, 8; postoperative deaths, 12	
<i>Spontaneous Recoveries</i> .....	3
(1) Gangrene of terminal portion of great toe (no operation)	
(2) Gangrene of heel (no operation)	
(3) Gangrene of middle toe (spontaneous amputation with healing)	
<i>Amputations</i> .....	25
Amputation of leg .....	1
Amputation of thigh .....	24
Five of these patients had preliminary toe amputations. All five required subsequent amputations at higher levels, with recovery.	
Deaths in thigh amputations .....	12 or 50%

*Anesthetics in Amputations of Thigh*

<i>Anesthetics</i>	Total	Recov- eries	Deaths
Gas-oxygen .....	7	3	4
Gas-oxygen-ether .....	2	1	1
Ethylene .....	7	5	2
Spinal .....	8	3	5
	—	—	—
	24	12	12

Of all the patients admitted in this group, 45 per cent died; of all the thigh amputations, only one in every two survived, the mortality here being exactly 50 per cent. Such a mortality is certainly a challenging one and can be reduced, we believe, only by adherence to the following points:

(1) An earlier resort to surgery in cases demanding operation.  
(2) No surgery at all unless it be radical surgery. Preliminary toe amputations or other minor procedures mean secondary amputations at a higher level with a progressively diminishing chance of survival.

(3) Close observation in the cases of dry gangrene, without infection, taking every precaution to avoid infection, while preliminary measures, medical and diagnostic, are carried out to determine the procedure to be followed and if amputation proves necessary, the level at which this can be successfully accomplished. Only in the occasional case, we believe, can this be done below the knee.

(4) Prompt, radical amputation through the thigh in cases of the moist type or with infection, avoiding drainage wherever possible, with the strictest attention to the minutiae of good surgery and staking everything upon securing of primary union in the stump. In the fulminating case, overburdened with toxemia from the infected, gangrenous limb, a guillotine amputation be-

## THE SURGICAL DIABETIC

low the knee, as McKittrick suggests, leaving the wound wide open, may give the patient his only chance to strike a balance before a secondary amputation through the thigh could be borne.

(5) The scrupulous avoidance of a tourniquet for gangrene of any type.

(6) Impartial selection of the anesthetic best suited to the individual case.

When we consider the management of the surgical diabetic, there should be no question as to where such a patient belongs. At our hospital, he is admitted on the diabetic service, regardless of the type of complication, and if the complication be eye, ear, nose or throat, urologic, abdominal, pelvic or of the extremity, the attending surgeon on the particular service is called in consultation. It is a recognized fact that under ordinary conditions, surgical delay is harmful; in diabetes it is disastrous. Medical treatment today is flexible and therefore the surgical condition dictates the type of treatment. Medical treatment can and must be adjusted to any type of surgical necessity.

Our system of treatment is based on certain well recognized fundamental principles:

(1) Infection makes the diabetes worse and therefore surgical removal of the focus of infection as soon as it is rationally possible is the best medical treatment we can give the patient.

(2) Treatment for the operation is our first consideration.

(3) We attempt to make the patient as good a surgical risk as is possible.

(4) Because delay is so harmful, the qualified surgeon is our referee as to the need for operation.

(5) The qualified physician prepares the patient and adjusts his dietary regimen to the surgical requirements.

Thus, to sum up, the rule to remember is that when we are treating a diabetic, we are treating a manifestly complex problem. Complications in diabetes prove disastrous, making the diabetes markedly worse, therefore, we must not waste time trying to make the diabetic sugar free because if at all accomplished, it is done at the expense of a great deal of body tissue and huge doses of insulin. We must vigorously attack the complications, thus lessening the severity of the diabetes, after which, simple regulation is all that is necessary. In our management of the various types of surgical procedures as we have grouped them, we carry out the following measures:

*Elective Cases*,—(1) In these cases we attempt to rid the patient of sugar and acetone.

(2) Our dietary program assures the patient a goodly intake of COH, ranging from 100 Gm. to 150 Gm., depending on the condition and state of nutrition. Thus a goodly amount of glycogen is stored in the liver. Insulin makes this a matter of ease. In total calories, however, the diet is slightly undernourishing. The high COH, low fat program, is the basis of the diabetic treatment at our hospital. In cases with general arteriosclerosis and arteriosclerotic heart disease, the heart and circulation are carefully watched and the blood sugar is never permitted to fall suddenly. Insulin



is used conservatively, for while our objective is diabetic control, it is dangerous to cause violent fluctuations in the blood sugar level because of the accidents which may occur in the heart and arteries.

(3) As the day of operation approaches, fat and then protein are omitted and 24 hours prior to operation, the diet consists of easily digested and absorbed COH only, plus fluids, salt and insulin.

(4) The patient is never starved prior to operation. He receives insulin, a COH breakfast by mouth or, in equivalent glucose in saline, intravenously, and two and one-half hours later goes to the operating room. The operation does not alter the established dietary routine of the diabetic at all. Following operation, he receives his luncheon COH in equivalent glucose in saline intravenously and his regulated dose of insulin follows. His supper, depending on conditions, is taken by mouth or is repeated intravenously as at lunch, again followed by insulin. We like the early and late method of the administration of insulin and use it a great deal. Included in this program are clyses, salt solution and tap water by rectum as indicated.

(5) On the day following operation, food is given by mouth and then the patient's program is reestablished with later additions of protein and fat. We have not found it necessary to do frequent blood sugar determinations for guidance in our program. The blood sugar is made relatively normal on the morning of operation and since operation does not alter the established program, frequent postoperative blood sugars are not indicated. The patient is eventually reregulated during his convalescent period. It is during this period that careful watch is maintained because the insulin requirement may change. Here blood sugar determinations are important in the guidance of the program. We have not had to be worried about postoperative hypoglycemia under this régime. Routine T.I.D. urines for sugar and acetone are done right on the floor by the nursing staff, who are carefully trained in the care and treatment of diabetics. All findings are charted on a special diabetic record sheet so that we know at all times just what is happening. Both the surgeon and the medical man take care of their respective duties and a condition of perfect cooperative harmony exists to the ultimate benefit of the patient. This routine is followed with indicated changes for diabetic obstetric cases as well.

*Essential Cases.*—The patient here is regulated to a COH and fluid intake only. Protein and fat are not included in his diet. While this patient may not be in urgent need of surgery, yet speed in his preparation may be necessary so that when after 24 to 48 hours operation may be deemed indicated, he will enter the operating room in good condition and well prepared. After operation his course proceeds as with the elective case.

*Urgent Cases.*—No attempt can be made to rid the urine of sugar and acetone in these cases. The patient receives a single dose of from 20 to 30 units of insulin and from 500 to 1,000 cc. of saline intravenously. Insulin, glucose and fluids here are given as indicated. There is no set rule as to the procedure in this type of patient. Every case is a distinct individual

problem and can be treated only as indications warrant. The patient is then operated upon. From this point, the case is then considered as one of acidosis and treated with all the details that the treatment of a case of diabetic acidosis entails.

In this survey of surgical diabetics at the Mary Immaculate Hospital, therefore, we have attempted:

(1) To review the difficulties which should be kept in mind in the surgical care of these patients with due emphasis upon the mortality which ordinarily accompanies the development of complications of this disease.

(2) To present an analysis of the conditions encountered at our hospital, with the operative work and results obtained.

(3) To discuss the measures which are followed in the general management of these cases.

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## INTESTINAL OBSTRUCTION

### EVALUATION OF THE ROENTGEN DIAGNOSIS

RICHARD A. RENDICH, M.D., AND HYMAN S. ABRAMS, M.D.

BROOKLYN, N. Y.

FROM THE DEPARTMENT OF RADIOLOGY, KINGS COUNTY HOSPITAL, N. Y. C.

REVIEWING the literature pertaining to the roentgen diagnosis of intestinal obstruction, one is likely to obtain the impression that the radiograph serves as a very simple and never failing means by which this condition can be diagnosed; a postero-anterior exposure, preferably with the patient in the vertical posture, without the aid of an opaque media appears to be the only requisite. The finding of gas within the small intestine on this film, according to some, suffices for a diagnosis of obstruction in patients over two years of age; in addition, evidence of fluid in the small intestine adds further but unnecessary proof. The object of the presentation of the analysis of this series is to point out that while the roentgenogram is very helpful in determining the presence and site of intestinal obstruction, the diagnosis is at times very difficult and occasionally definite conclusions cannot be drawn from a single roentgen examination.

Schwartz<sup>1</sup> reported on the roentgen ray examination of the abdomen without the use of opaque media in 1911. Since that time Assmann,<sup>2</sup> Case,<sup>3</sup> Bensaude and Guénaux<sup>4</sup> and many others have contributed to our knowledge of the subject. Briefly, practically all agree that the presence of distended loops of bowel, particularly with intra-intestinal fluid levels, is indicative of obstruction. Many are of the opinion that any gas in the small intestine in patients over two years of age is abnormal and should be considered the result of obstruction. Kalbfleisch,<sup>6</sup> in 1927, stated that distended loops of bowel may be considered pathognomonic of intestinal obstruction and the presence of even one fluid level is confirmatory evidence.

As to the time of appearance of these radiographic findings, Case<sup>3</sup> reported in 1928 that gas and fluid began to accumulate within six to eight hours after obstruction had been established. The time interval for experimental visualization reported by Wagensteen and Lynch<sup>7</sup> was four or five hours after simple obstruction of the small intestine had been established; they added that in obstruction with strangulation, gas accumulated later and in smaller amount. In 1933, Ochsner,<sup>5,9</sup> from an experimental study, deduced that the lower the obstruction the greater is the amount of gas and fluid accumulation, and that these features were more marked in strangulated than in simple obstruction; he also mentioned that in both simple and strangulated obstruction of the ileum the amount of gas present one hour after the production



FIG. 1 (Case I).—This and the succeeding two figures demonstrate the progression of a distal ileal obstruction made possible by the patient's refusal to consent to early operation. The above figure represents the findings 22 hours after onset of illness and demonstrates the dilatation of the small bowel well above the point of obstruction.

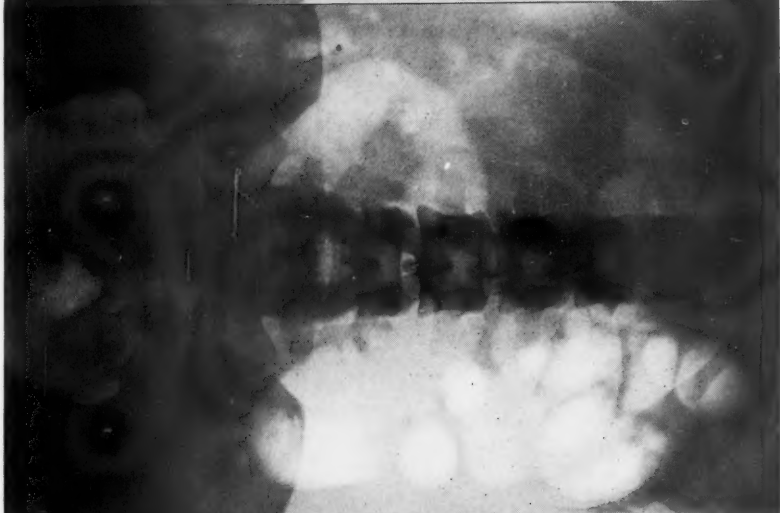


FIG. 2 (Case I).—Forty-five hours after onset of illness, shows more marked and extensive gaseous distention and absence of fluid.



FIG. 3 (Case I).—Demonstrates fluid levels but less gas 133 hours after onset of illness.

of the obstruction permitted a positive roentgen ray diagnosis, and with simple jejunal obstruction as early as three hours.

Intra-intestinal gas is associated with the paralytic as well as the mechanical form of obstruction. In the latter type, exemplified by the chronic obstruction, according to Boyd,<sup>10</sup> stenosis occurs gradually with resulting dilatation and hypertrophy above. When complete, paresis and degeneration of the musculature occurs proximal to the obstruction; gases formed from the accumulated contents contribute to the dilatation. In the acute paralysis, frequently the result of general or localized adhesive peritonitis, stagnation of contents with gas formation also occurs. In strangulation the accumulation of gas is also due to the interference of the usual gaseous exchange. The



FIG. 4 (Case II).—Ileal obstruction demonstrating the position and configuration of the bowel with fluid levels as presented in the transabdominal exposure.

intra-intestinal fluid noted above the point of obstruction results from the hyperactive irritated intestinal glands, the inflammatory exudate and the non-absorbed ingested fluids.

The gas-containing intestine may be identified by its contour and position. The irregularity of outline of the small intestine resulting from the valvulae conniventes may be noted beyond the first portion of the duodenum through the jejunum and in the proximal portion of the ileum. These mucosal folds present on the radiograph what has been referred to as the herringbone appearance. On marked distention these plications viewed obliquely present an elliptical appearance and may be confused with the haustration of the large intestine; the intervals of indenture of contour are greater in the



# DIAGNOSIS OF INTESTINAL OBSTRUCTION



FIG. 5 (Case T54).—Intestinal obstruction occurring two weeks after appendectomy, showing localized distention of the jejunum. Note similarity of Fig. 11 of nonobstructive distention.

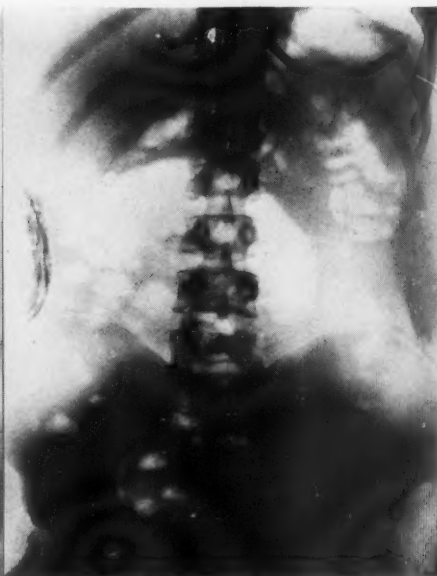


FIG. 6 (Case T51).—Ileal distention with fluid levels in a patient two months postappendectomy.



FIG. 7 (Case T51).—Radiograph after three-hour interval. Localized ileal distention now absent. Symptoms subsided. (No operation.) Probably indicative of a transient ileal obstruction.



FIG. 8 (Case VII).—Rectosigmoid obstruction resulting from carcinoma of this area. Shows marked dilatation of the colon with no fluid levels and also dilatation of the upper ileal loops apparently the result of small intestinal fixation in the mass.



FIG. 9 (Case T55).—Carcinoma of cecum with metastasis to liver demonstrating extensive small intestinal dilatation.



FIG. 10 (Case T56).—Nonobstructed case. Clinical diagnosis of chronic nephritis. Shows localized small intestinal dilatation as frequently noted in the debilitated patient.



FIG. 11 (Case T57).—Nonobstructed case demonstrating dilated parallel loops of small intestine noted during the course of a urologic work-up. Note small intestinal distention somewhat similar to Fig. 5. Some large intestinal gas present in this case.



FIG. 12 (Case T60).—Nonobstructed case demonstrating fluid levels and dilatation of both small and large intestines after enema and catharsis.

colon. On account of the relationship of the small intestinal coils there is produced the familiar stepladder effect in the presence of air and fluid. The jejunal loops are more commonly found above and to the left of the midline, and the ileum below and to the right. The colon may be distinguished by its haustration, as well as by its larger caliber. The maximum distention of the colon was found to be 12 cm., while that of the small intestine was 5.8 cm. (film measurement corrected for distortion). On marked distention the characteristic irregularities of contour may be effaced and the gut displaced from its usual position rendering a decision as to the exact segment involved very difficult if not at times impossible.

For radiographic examination of the obstruction suspect the vertical or semivertical posture serves most satisfactorily; this position is best obtained with the aid of the tilt-type table. In the absence of such special apparatus, the transabdominal exposure may be used to obviate any inconvenience to the weakened patient.

As stated, the roentgen diagnosis of obstruction of small or large intestine without the aid of an opaque medium is dependent upon the finding of intra-intestinal gas and fluid. Certain authors hold that gas found in the small intestine of patients beyond two years of age indicates obstruction; yet on numerous occasions during abdominal examinations for other than intestinal conditions, gas of varying amounts and fluid levels have been found in the small bowel. The writers are of the impression that fluid levels may be found more frequently in the nonobstructed case if the vertical position were utilized more commonly for other examinations.

Any active evacuant, especially the more irritating, may produce intestinal gas and fluid (Fig. 12). A series of examinations made after active catharsis by various means proved this contention; true enough, the amount in some instances was small, but in others sufficient to confuse one when the diagnosis of obstruction is under consideration. Since early purgation is usually practiced by patients suffering from abdominal symptoms, it becomes essential for the roentgenologist to be acquainted with the history before arriving at any conclusions. The postevacuant film with small intestinal gas and fluid usually can be differentiated from that of mechanical obstruction by the fact that large intestinal gas is rarely present in true obstruction of the small gut but is a common finding after catharsis.

Small intestinal gas is invariably found in the infant and in lesser amount in children up to ten years and older. In adults gaseous distention and occasionally fluid have been found with the following conditions: peritonitis, acute gallbladder and appendiceal pathology, ureteral calculus, allergy, severe abdominal trauma, fracture of lumbar vertebrae, acute pelvic conditions, *etc.* In these instances the intestinal stasis appears to result from a nonmechanical form of obstruction. In addition to the abnormalities mentioned, examina-

tions were made of debilitated patients suffering from nephritis, cardiac pathology, *etc.*, and frequently in these considerable gas collections were demonstrated in the small and large intestine (Fig. 10). Local areas of gaseous distention of small gut are very frequently associated with ureteral catheterization. The distention of the adynamic type of obstruction is usually much more generalized involving long continuous segments of the intestine, small and large; fluid levels may be present but more frequently are absent in this variety of stasis. Judging from the radiographic study of intestinal obstruction it appears that there frequently occurs an ileus of the adynamic type as a consequence to the underlying cause of a mechanical obstruction; this seems to be borne out by the fact that distention may be first found well above the point of mechanical obstruction, and secondly by the fact that the intestinal distention proximal to it is occasionally very extensive and uniform as noted with the adynamic variety.

Since intra-intestinal gas and fluid do not always indicate mechanical obstruction, it becomes important to decide if possible upon the criteria requisite for a roentgenologic differentiation as to the cause of distention. Experience proves the futility of dogmatic statements concerning this differentiation. The diagnosis of mechanical obstruction does not appear to be as dependent on the presence of gas and fluid within the intestine as upon the degree of distention. A small amount of intestinal gas is of little significance, while distention beyond the width of the normal lumen usually indicates obstruction and represents one of the most distinguishing diagnostic features of this condition; of greater importance is the persistence or increase of this distention after an interval. Frequently the original radiograph is not sufficiently characteristic to warrant a definite diagnosis of obstruction worthy of surgical interference. Consequently, reexaminations should be made at two-hour intervals while the findings are indefinite (Figs. 6 and 7).

While the gas collection usually increases with true obstruction, the amount may on occasions even be lessened after an interval. This has been noted in several cases of high jejunal distention; reverse peristalsis and regurgitation may account for its expulsion. Likewise, the intestinal pattern and fluid levels may be altered by a simple change of position of patient when the gas is free to pass from one to another loop above the site of obstruction. The important point appears to be that the distention just proximal to the point of obstruction, that is, the area of most distal distention, persists while the gas in the nonobstructive case usually passes on during the interim.

At times there appears a markedly distended loop of upper jejunum with a similar condition of the terminal ileum, while at operation but one point of obstruction may be noted and that in the most distal area. Apparently this results from a paresis of the gut proximal to the point of obstruction. Such possibility must be borne in mind when information is desired by the surgeon as to the site of obstruction.

# DIAGNOSIS OF INTESTINAL OBSTRUCTION

TABLE I

Case No.	Age	Duration of Present Illness	Röntgenographic Findings of Intestinal Dilatation	Location of Obstruction	Roentgen Ray	Surgery or Necropsy	Case No.	Age	Duration of Present Illness	Röntgenographic Findings of Intestinal Dilatation	Fluid Levels of Roentgen Exam.	Surgery or Necropsy	Discharge Diagnosis	Remarks
1	20	22 hrs.	+	-	Distal ileum	Distal ileum	21	30	10 days	-	+	Enema?	Hemorrhoids, rectocele	Had enema and mineral oil 12 hrs. before Enema
2	26	118 hrs.	+	+	Distal ileum	Distal ileum	22	65	4 days	+	+	Enema or obstruction?	Constipation	
3	60	2 wks.	+	+	Distal ileum	Distal ileum	23	68	24 hrs.	-	+	Left ureteral calculus	Left ureteral calculus	Enema 2 hrs. before Had castor oil
4	23	5 days	+	+	Proximal ileum	Proximal ileum	24	31	66 hrs.	+	+	Partial obstruction of descending colon	Left salpingo-oophoritis	Had enema 3 hrs. before
5	67	5 days	+	+	Distal ileum	Distal ileum	25	35	64 hrs.	+	+	Enema or obstruction of ascending colon	Acute cholecystitis	
6	58	9 days	+	+	Descending colon	Descending colon	26	26	3½ days	+	+	Obstruction of ascending colon?	Ruptured peptic ulcer? Mesenteric thrombosis?	Had enemas and cathartics
7	64	10 days	+	-	Descending colon	Descending colon	27	52	2 mos.	+	-	Obstruction of transverse colon	Bilateral hydro-nephrosis	
8	56	3 days	+	-	Proximal ileum	Descending colon	28	18	12 days	+	-	No obstruction	Left ureteral calculus	Purgation and enema
9	50	6 hrs.	+	+	Descending colon	Descending colon	29	46	2 wks.	+	-	No obstruction	Right perinephritic abscess, ureteral calculus	
10	28	10 days	+	-	Jejunum	Jejunum	30	35	6 days	+	+	No obstruction	No obstruction	Had castor oil, enema 2 hrs. before No history of cathartics
11	35	5 days	+	-	Descending colon	Descending colon	31	66	7 days	+	+	Obstruction of sigmoid colon	No obstruction	
12	54	4 days	+	+	Midtransverse colon	Sigmoid	32	30	3 days	+	-	Obstruction of distal ileum?	Empyema of gall-bladder	
13	58	3 wks.	+	-	Descending colon	Descending colon	33	58	2 days	+	+	Enema or obstruction of ascending colon	Cholecystitis	Enema 7 hrs. before
14	47	96 hrs.	+	-	Lower Jejunum	Jejunio-ileal	34	52	2 days	+	-	Stasis or obstruction of proximal ileum	Cholecystitis	No enema or cathartics
15	32	3 days	+	+	Distal ileum and descending and ascending colon	Distal ileum and sigmoid	35	37	16 days	+	+	No obstruction	Retrocecal abscess. No obstruction.	No enema or cathartics
16	61	24 hrs.	+	+	Distal ileum	Distal ileum	36	63	5 days	+	-	Stasis in terminal and medial ileum	Metastatic epidermoid carcinoma of inguinal lymph nodes	Efferential enema 1 hr. before
17	28	96 hrs.	+	+	Jejunum	Small intestine	37	67	52 hrs.	+	-	Obstruction of terminal ileum	Acute suppurative appendix	No cathartics or enema
18	29	48 hrs.	+	-	Distal ileum	Distal ileum	38	49	6 days	+	-	Stasis or obstruction of distal ileum	Uremia, nephritis, splanchnitis	Bowel movements normal
19	14	3 days	+	+	Proximal ileum	Proximal ileum	39	40	4 days	+	-	Obstruction of distal ileum	Intestines markedly distended. Show no pathology. Lacerated liver	Had enemas
20	41	2 wks.	+	+	Descending colon	Descending colon	40	48	3 days	+	+	Obstruction of proximal ileum	Intestines markedly distended. Show no pathology. Lacerated liver	Enema 6 hrs. before



The problem involved in connection with this subject appears not to be in making the roentgen diagnosis of intestinal obstruction, but in excluding such a condition when it does not exist. Table I well demonstrates the difficulty; these cases represent 20 consecutive proven cases of intestinal obstruction and 20 of nonobstruction referred for abdominal study to confirm or exclude obstruction. In 12 cases, 60 per cent of mechanical obstruction cases, fluid levels were demonstrated; while in 11 cases representing 55 per cent of the nonobstructed group, this feature supposedly pathognomonic of dynamic obstruction was noted. In 100 per cent of the former and 90 per cent of the latter variety gaseous distention was noted. In many of the second group the possibility of obstruction could not be excluded on the initial examination. This form of investigation of the obstruction suspect becomes more dependable as a means of corroboration rather than exclusion of such a possibility. The roentgen diagnosis must be based on the degree of distention and the constancy of the findings.

#### CONCLUSIONS

Roentgen study of intestinal obstruction without the use of an opaque medium is very valuable but the diagnosis by this means is not always a simple matter.

Gas and fluid levels may be present in the intestine in the absence of obstruction.

Generalized distention, usually without intra-intestinal fluid, is noted in the paralytic form of obstruction.

While the important diagnostic features are the gaseous distention and fluid levels, interval examination to determine the persistence of these is often necessary for definite diagnosis.

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## THE PROBLEM OF NON-CALCULOUS URETEROPELVIC OBSTRUCTION \*

AUGUSTUS HARRIS, M.D.

BROOKLYN, N. Y.

THIS condition is not infrequently one of the most formidable problems with which the urologist has to deal. Inasmuch as the use of the ureteric catheter has failed to a considerable degree in overcoming and canalizing obstructions of the ureter at the level of the renal pelvis, we are forced to a consideration of some more adequate means of providing (renal) drainage. Moreover, it is to be noted that certain of these obstructions react unfavorably to instrumental ureteral manipulations. Given a case in a relatively young, vigorous person with an obstructive ureteropelvic lesion sufficient to produce rather severe symptoms with recurrences over a considerable period of time, in which the kidney is found to be functioning well, how is the operator to relieve this obstruction without sacrificing the kidney? We must face the challenge of providing adequate (reno-ureteral) drainage by conservative operation or remove the organ.

It is most unfortunate that the urologist sometimes finds it necessary to remove a kidney for a marked pyonephrosis as the end result of severe obstruction from stenosis, stricture or aberrant vessel at the pelvic outlet. We recently removed a kidney in an advanced state of disease in a boy of eight years. It is worthy of note that the history of pain was only of three weeks' duration with no previous attacks. He had urographic evidence of slight obstruction to the pelvis of the remaining kidney without pain. I believe there is an aberrant vessel on this side and have determined to operate at the first sign of definite renal pain, should it occur. Four months ago a pyonephrotic kidney was removed in a woman 36 years of age who gave a history of intermittent pain for twenty years. She had never been cystoscoped. The pelvis was of the intrarenal type, with the outlet almost effaced by a very dense, thick stricture.

It is worthy of note that the larger percentage of these lesions occur in minors and relatively young adults. Obviously in the poorer-risk patient and the one more advanced in years, plastic operations may be very unwise. On the other hand, where the opposite kidney has been removed or where its function is markedly impaired, one is forced to undertake a conservative plastic procedure.

To recapitulate, the following are the chief causes of high obstruction: (1) Stenosis or stricture at the ureteropelvic junction; (2) congenital muscular hypertrophic stenosis caused by hypertrophy of the middle circular layer

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\* Read before the Genito-Urinary Section of the New York Academy of Medicine, February 20, 1935.

## URETEROPELVIC OBSTRUCTION

of smooth muscle:—this might be considered an analogue of congenital pyloric stenosis; (3) aberrant renal vessels; (4) ptosis of kidney with redundancy and kinking of the ureter; (5) periureteral bands or adhesions; (6) stricture after injuries or operative procedures; (7) pressure of new growth from without; (8) valve-like projections of ureter into pelvis or pelvis into ureter; (9) abnormally high and oblique insertion of the ureter; (10) renal sympatheticotonia; so-called by Harris and Harris.<sup>13</sup> This is presumably a condition of spasm of the smooth musculature due to overstimulation of the vasoconstrictor fibers of the sympathetic nerves often associated with mild hydronephrosis and with no other mechanical obstruction. This last condition may not be generally accepted. A. von Lichtenberg<sup>11</sup> has encountered dynamic or functional spasm of the circular muscle (as in pylorospasm) not infrequently and has observed marked spasm at the ureteral outlet during operation. He usually dilates the orifice through a small pyelotomy incision and cuts the circular muscle at the junction, closing the incision in the opposite direction. It must be stated that in about one-half of his plastic cases he was unable to demonstrate a true mechanical obstruction, a fact that would indicate that the spasm from disturbed neuromuscular function may have been, in reality, the functional syndrome of Harris and Harris<sup>13</sup> and of Papin. Perhaps renal sympathectomy would be the logical procedure for cure of this dynamic spasm. It is quite dramatic to see the relief of severe spasmodic recurrent renal colic afforded by means of renal sympathectomy. This syndrome helps to explain the existence of hydronephrosis in the absence of any demonstrable obstruction.

It will be noted that we have not mentioned the most common of all obstructions at this level, namely, calculus. In the absence of any of the previously mentioned conditions, simple pyelotomy and stone removal afford relief unless the resultant renal damage requires nephrectomy. In calculus associated with extrarenal hydronephrosis, it would seem wise to resect a fairly sizable portion of the renal pelvis, in the hope of minimizing the factor of urinary stasis. We have done this a number of times with gratifying results. In resecting tissue of the pelvis it appears logical to remove it from either the superior or the inferior border according to the circumstances, taking away an approximately equal amount of tissue from both the anterior and posterior surfaces. In so doing, there is no distortion of tissue following closure of the incision and the ureteropelvic relationship is not altered.

Ptosis with kinking of the ureter has not been discussed, as the diagnosis and operative procedure are usually simple and the results excellent.

In the case of removing periureteral bands near the pelvis, resulting from old inflammation or following former injuries, we believe the use of the No. 8 F. ureteral catheter to splint the ureter during the period of healing to be very advisable. This will maintain its proper direction and reduce materially the tendency to distortion. This procedure was applied in a young woman who had two dense linear strictures in the wall of the ureter 2 cm. apart and 3 cm. below the pelvis, after repeated attempts to pass any instruments

through the obstruction from below had failed. At operation, through the pyelotomy opening the ureter could be gradually dilated from above downward, using small sizes at first. The catheter was left *in situ* for one week bringing it out transrenally through the opening made by a trocar. I have never encountered such strictures in the walls of the upper ureter at any distance from the pelvis.

When an aberrant vessel of moderate size is encountered, (with or without an associated interstitial band, and with or without ptosis), section of the vessel, removal of the interstitial band, if present, and anchoring the kidney in high position, if necessary, is usually all that is required. Partial resection of a large redundant pelvis resulting from this condition may also seem advisable.

Plastic procedures for the relief of other forms of obstruction have seemingly been largely abandoned by many competent urologists because of the rather large percentage of bad end-results requiring secondary nephrectomy. A. J. Scholl and E. S. Judd<sup>3</sup> have reported a series of 39 plastic operations on the pelvis in 11 of which secondary nephrectomy was required; a percentage of failure of about 28 per cent. Eisendrath states that, "of all the types of pyeloplasty, reimplantation of the ureter offers the best outlook." Because of two unfortunate experiences of the past, in severing the ureter completely, and failure after suture, requiring nephrectomy, we are fearful regarding complete division of the ureter at or near the pelvis. There is a rather general opinion to the effect that once the ureter is severed, the kidney to all practical purposes cannot be saved. Wildbolz appears to have been very successful with reimplantation of the ureter for aberrant renal vessel where he prefers this procedure to sacrificing the vessel. He objects to the resultant necrosis, scarring and diminished renal function resulting from section of the vessel and reports a considerable degree of success in maintaining good renal function, even several years following replacement of the ureter to a correct position and suture to the pelvis.

A. von Lichtenberg<sup>11</sup> has reported 47 conservative operations, in only three of which secondary nephrectomy was required. However, instead of transplanting the ureter in conditions of aberrant vessel, he sections the accessory vessels, to avoid disturbance of function which he believes is the result of dividing the nerves. In this connection, one must be mindful of the fact that accessory vessel obstruction is very frequently bilateral and one may hesitate to cut sizable arteries on both sides where a considerable degree of bilateral obstruction results from them. This amounts to bilateral partial nephrectomy.

Marion and Legueu go so far as to state that suture of the ureter is useless. This statement does not seem well founded, in view of the brilliant, though limited, success obtained by certain operators over periods of 10 to 20 years.

Quinby<sup>7</sup> has reported uniform success in seven cases with transplantation of the ureter into the dependent portion of the pelvis. In some of these,



many years had elapsed before reporting end-results. In each of this series an aberrant vessel was the cause of obstruction. While symptomatic relief and maintenance of good renal function was obtained, subsequent pyelographic study has been recorded in only two or three of the entire series. He has been much more successful with ureteropelvic anastomosis than with longitudinal incision and transverse closure of the outlet. He never employs an indwelling ureteral catheter and rarely performs nephrostomy. In a recent personal communication he reports that his end-results continue to be entirely satisfactory.

A. von Lichtenberg's unusual success in plastic procedures may be largely due to his routine nephrostomy drainage, which he considers indispensable. He rarely performs partial resection or plication of a redundant pelvis and usually reimplants the ureter for conditions of abnormal insertion.

Waltman Walters<sup>12</sup> has reported success after pelvic resections in a number of cases. One of these included a repair procedure on both pelves. What is more significant than this, is the fact that ureteropyeloneostomy performed by him for the relief of a completely obstructed (acquired) solitary kidney, showed a successful result four years afterward. He recommends transplantation of the ureter in preference to ligation of large accessory vessels. He reminds us that the vessels should first be temporarily compressed with a rubber covered hemostat to determine the amount of interference with renal circulation. This should be the deciding factor as to whether the vessel should be sacrificed. This technical procedure was well demonstrated in one of my own patients, a child of twelve years, in whom clamp compression of a fair-sized aberrant vein affected the circulation in the lower one-third of the kidney only temporarily. The application of hot compresses to the kidney brought back the natural color after a few minutes. There was no aberrant artery.

The scope of this report does not permit of a consideration of all the types of plastic procedures devised. The Heineke-Mikulicz principle of pyeloplasty is still used to some extent—to widen the ureteropelvic orifice, making a longitudinal incision and closing it transversely in the opposite direction, so that the extremities of the original incision become the central point in the suture line. This method was applied in two of our cases. It is important to remember that too long an incision puts too great tension on the sutures, whereas too short an incision leaves the aperture too small, with stenosis likely to recur. Some have successfully employed a Y-shaped incision for widening the aperture for a strictural condition.

It is to be noted in all plastic work that stenosis may progress after operation very gradually so that the immediate functional capacity may be normal, whereas, after a term of years, it may be one-half or one-third normal, until ultimately the obstruction effects complete atrophy. On the other hand, there are records to show ureters remaining patent for as long as 20 years, where the kidney had gradually lost its function completely. It is

obvious that one cannot consider end-results without a prolonged period of observation.

Dr. Charles H. Peck<sup>6</sup> has contributed a very useful principle of splinting the ureter by the passage of a catheter well down to the bladder and bringing it out through the kidney cortex after making a small stab wound through the kidney. The proximal end is brought out through the upper angle of the incision and is left in position for four to six days to canalize the lumen of the ureteral opening and to prevent distortion and kinking during the earlier stages of healing. We have used this method a number of times and believe it is a valuable aid in minimizing and preventing post-operative stenosis. To reduce the amount of trauma to the kidney substance in passing a clamp or other instrument through the kidney, we have devised two small six-inch trocars (with round points), the lumina of which accommodate a No. 6 F. and No. 8 F. ureteral catheter or bougie respectively. A long (urethral) alligator forcep is very useful in making the nephrostomy wound for placing the nephrostomy tube and minimizes the parenchymal damage.

Küster was among the first to implant the ureter into the pelvis successfully in 1891 and Fenger performed a similar operation shortly afterward. He speaks of probing the ureter with a No. 9 F. to No. 12 F. metal bougie through the kidney wound; apparently he employed nephrostomy drainage, a factor which may have contributed largely to the satisfactory result.

The results of the animal experimental work of Iselin<sup>10</sup> afford a more hopeful outlook in ureteropyeloplasty. He concludes that ureteral section does not ultimately necessitate nephrectomy for a resultant degenerated and atrophied kidney as formally claimed, but that the stenosis from healing is the serious complication and the cause of the bad results. He argues and has shown, to some extent, at least, that by "side-tracking" the urine flow by pyelostomy above the point of suture and by placing a No. 8 F. to No. 10 F. ureteral bougie down the ureter, favorable results will follow ureteropelvic anastomosis. He warns that eversion is to be avoided by removal of any redundant portion of the mucous membrane of the ureter. In a limited number of dogs he found that loss of peristalsis occurred temporarily in the proximal portion of the severed end. The regular motility, however, returned normally within a few weeks and kymographic tracings recorded this activity as long as 102 days after ureteral section. The persistence of inertia was only seen in the presence of cicatricial stenosis.

A study of the literature reveals numerous failures where the ureter was inserted with projection into the pelvis, and valve-like elevations resulted. Certainly, end-to-end closure appears to be the better method.

#### CONCLUSIONS

It seems reasonable to conclude, therefore, that the following fundamental principles of technic in all plastic operations on the pelvis assure greater safety and hope of success. (1) Following operation, a No. 6 F. to No. 8 F.

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ureteric catheter or bougie should be passed down the ureter and brought out through the kidney and upper angle of the wound (Peck method) and left in position for five to seven days. (2) In anastomotic procedures the pelvis should be drained through a nephrotomy wound by a catheter of size 14 F. to 16 F. for a period of five or more days. Nephrostomy is as logical in this instance as cystotomy for plastic operations on the urethra. This eliminates the effect of increased intrarenal pressure and stasis, upon the kidney and the suture line, and meets the factor of associated infection. (3) End-to-end ureteropelvic anastomosis offers a better outlook than other methods of partial plastic repair of the outlet and is preferable to insertion of the severed ureter stump into the cavity of the pelvis. (4) The perirenal space should also be adequately drained for, at least, a week after operation.

It is to be hoped that plastic surgery of the pelvis will, in the not distant future, prove to be more practical and useful, and that errors and pitfalls may be overcome, to the end that many kidneys may be saved. It would seem advantageous to have some clearing house or reference bureau to record data of all plastic work done by various operators, in America; this to include continued follow up information.

Further experimental work along the line of that of Iselin appears necessary.

Appended are four histories of recent cases, illustrative of conservative operative procedures which have resulted in complete relief of symptoms and conservation of a normally functioning kidney.

### CASE REPORTS

*CASE I.—Hydronephrosis—Linear Stricture of the Ureter at the Junction of the Pelvis—Incision and Plastic Repair.*—J. M., a vigorous male of 43 years, hospital orderly, was admitted September 11, 1934, with severe attack of left renal colic of two days' duration requiring morphine for temporary relief. This was accompanied by fever and typical tenderness over the affected kidney. There was a rather long history of backache and fatigue on exertion; the last severe attack of colic occurred about two months before admission. History and physical examination and laboratory data were essentially negative, excepting the urinary tract.

Cystoscopy revealed an apparent obstruction to the catheter in the region of the pelvis on the left side with moderate pyuria and normal differential P. S. P. test. The right renal urine was clear with normal elimination of the dye. There was a small faint shadow in the region of the pelvis which was interpreted as a possible calculus. Ureteropyelogram revealed an hydronephrosis with obstruction at the pelvic outlet either from aberrant vessel or stricture. Operation, a few days later, revealed a slightly enlarged kidney which appeared well preserved. A very short vascular pedicle, even after rib resection, did not permit of delivery of the kidney. A dense linear stricture was encountered at the junction of the pelvis and ureter about one-half inch long. Pyelotomy together with careful search of the pelvis, and calices, including needling of the kidney, failed to disclose a stone. The wall of the pelvis was considerably thickened. An incision was made through the dense strictured ureter, and a modified Heineke-Mikulicz repair procedure was done with a catheter in the ureter, making an ample aperture at this site. The operation was quite difficult owing to the short vascular pedicle and required two hours for completion. There was a moderate febrile course for six to seven days with rather free urinary drainage from

the loin. Twelve days after operation an indwelling ureteric catheter was passed into the pelvis from below and left in position for 48 hours. Again, four weeks after operation, a No. 9 F. Garceau catheter was passed and left in position and the patient was discharged from the hospital five weeks after operation with flank wound almost completely dry. About one week later there was a return of moderate urinary drainage for a few days, after which the wound closed permanently. A catheter was subsequently passed easily on two occasions at intervals of four to six weeks. On February 12, a No. 9 F. Garceau catheter was easily passed and urine found to contain small amounts of pus. The P. S. P. test was normal. On the preceding cystoscopy the urine from the left kidney was clear. Patient is continuing his usual occupation and enjoying excellent health. He has gained considerable weight and appears robust.

CASE II.—*Hydronephrosis—Stenosis of Ureteropelvic Outlet and Hypertrophy of Ring Muscle—Incisions and Plastic Repair.*—Mrs. A. C., housewife, 30 years of age, was admitted September 13, 1934, with complaint of persistent pain of varying severity in the right lumbar region and flank of eight months' duration. The pain was often aggravated by physical exertion. There was moderate tenderness and jar tenderness over the right kidney, the kidney was not palpable. The catheter passed readily to both pelves with return of moderately cloudy urine from right and clear urine from left. The P. S. P. test was normal on both sides. Ureteropyelogram revealed a mild hydronephrosis on the right side and suggested a kinking and angulation of a redundant ureter. There was also a greater amount of hydronephrosis on the left or symptomless side. At operation the right ureteropelvic junction was found to be definitely stenotic, with hypertrophy of the ring muscle at this point. There was no ptosis or unusual mobility of kidney. Pyelotomy incision was made, exposing the orifice from within. Two small incisions were made through the mucosa and musculature on the interior and a third incision was carried completely through the area of obstruction. With a catheter in the ureter, a closure in the opposite direction was made providing an ample opening. The appearance after closure seemed so satisfactory that no indwelling catheter was used. I believe this was a mistake and that the subsequent pyelogram proved that temporary stenosis, at least, occurred with increased intrarenal pressure and dilatation of calices. Moderate urinary leakage occurred from the wound for eight days. An indwelling catheter below for 48 hours kept the flank dry. Two weeks after operation a second indwelling catheter was placed because of slight urinary drainage from the wound, and, three days subsequently (17 days after operation), patient was discharged from the hospital with the wound completely healed. Since that time the ureter has been catheterized on two occasions, the last time on February 18, 1935, when the urine was perfectly clear and the P. S. P. test normal. The pyelogram, however, showed greater dilatation than before operation and we were surprised, inasmuch as there has been no pain or renal tenderness since.

In cases of this type we believe the catheter splint is of definite value and should be used as a routine. When infection is associated, nephrostomy with 14 F. to 16 F. tube is advisable.

Since this report was made a similar plastic procedure was done on the opposite kidney pelvis with drainage with complete success. This was required for relief of severe obstruction and persistent colic.

CASE III.—*Hydronephrosis—Aberrant Renal Vein—Resection of Aberrant Vessel and Redundant Pelvis.*—Mrs. M. F., housewife, 36 years of age, was admitted September 12, 1934, with pain in the left lumbar region radiating downward and forward from which she had suffered during the preceding four months. Several severe attacks during this time were not relieved by medication. There was moderate tenderness in the left flank with kidney not palpable. The physical examination and laboratory work were essentially negative, excepting ventricular myocardial disease as proven by the cardiogram.

Cystoscopic and pyelographic study showed bilateral hydronephrosis with the film appearing typical of bilateral aberrant vessels. Both kidneys showed normal function and

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were free of infection. It is interesting to note that greater dilatation occurred on the symptomless side. At operation a moderate sized vein was found to cross the junction anteriorly in such a manner as to definitely obstruct, and the vessel entered the lower pole of the kidney. The hydronephrosis was greater than indicated on the pyelogram. There was no interstitial band or demonstrable ptosis. The vessel was clamped in two places and resected. Following this an elliptical portion of the redundant pelvis was resected from the lower border, removing an equal amount of tissue, half from the anterior and half from the posterior surfaces. An inlying No. 8 F. splint catheter was brought out through the kidney and left in for seven days. There was some febrile reaction for about eight days. Moderate urinary drainage from the flank continued for 10 or 11 days. Patient was discharged in excellent condition, 18 days after operation, with wound healed.

Symptoms have been completely relieved. Pyelography on January 29 showed some hydronephrosis remaining on left side, despite pelvic resection. The first pyelogram had evidently not filled the left pelvis completely. Hydronephrotic drip was found only on the right side (non-operated) at the last examination.

CASE IV.—*Renal Sympatheticotonia or Sympathetic Nerve—Muscle Spasm—Renal Sympathectomy.*—Miss H. W., a nurse in training, aged 21, was admitted to the hospital August 15, 1934, with severe and persistent left renal colic. She had been admitted to the hospital on three previous occasions for relief of pain which at times appeared to be typical of stone in the kidney or ureter. She was of a distinctly emotional type and had suffered from some ovarian dysfunction with endometrial hyperplasia for which she had been treated by a gynecologist. Two years before I had thoroughly studied this patient by cystoscope and by intravenous urography and retrograde pyelography. She remained in the hospital for one month. A diagnosis of sympatheticotonia was made. She was advised to live out of doors for six months and eserine was given intermittently by mouth. Persistent colic recurring, she was again thoroughly studied and no other lesion of the ureter or pelvis could be demonstrated. Repeated narcotics and sedatives in large doses had failed to give relief and sympathectomy was decided upon. Operation performed August 21, 1934. The sympathetic nerve structures were removed from the renal pedicle and upper third of the ureter. She has obtained complete relief from the renal pain. This is the fifth successful case of sympathectomy in our series where all conservative treatment and in whom the use of eserine and other antispasmodics were of no avail.

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## THE TREATMENT OF COMPOUND FRACTURES WITH SPECIAL REFERENCE TO THE ORR METHOD\*

DAMON B. PFEIFFER, M.D.

AND

CALVIN M. SMYTH, JR., M.D.

PHILADELPHIA, PA.

COMPOUND fractures have always constituted an important group of civil and industrial injuries. With the ever increasing number of automobile accidents, all surgeons are being called upon to treat more of these cases each year. The results at the present time vary all the way from brilliant to horrible, and any method recommended to the surgical profession at large should be one which the surgeon of average skill and experience will be able to carry out in the hospital of average equipment and personnel.

The methods of treating this group of injuries have varied from time to time with changing concepts of the treatment of infected wounds. In the early days of surgery compound fractures frequently resulted in death or amputation and whether this was done early or late depended on such factors as location, severity, hemorrhage or infection. From the adoption of antiseptic surgery the attention of surgeons has been primarily concentrated on the problem of handling infection in these cases. This undoubtedly worthy objective has, however, not always worked to the ultimate benefit of the patient, for, in concentrating upon the problem of infection, the fracture has been neglected. Too often one hears the statement that "we must forget the fracture and treat the patient." This is, of course, a most comfortable attitude for the surgeon to assume because it immediately relieves him of all responsibility for a bad result and places the burden on the Almighty. Of compound fractures Orr has said that the principles of orthopedic treatment have been sacrificed to the supposedly necessary but actually dangerous combatting of infection within the wound. With the introduction of the Carrel-Dakin treatment of wounds the ultimate in this point of view was achieved. No one can dispute the brilliant results that were obtained by the correct application of this method if our estimate is limited to a consideration of the infected wound alone, but neither can it be denied that it often disregarded the fracture. The infected wounds cleaned up and healed, but the records of the surgeon general's office show a disheartening number of patients still disabled on account of this disregard. Another objection to the Carrel-Dakin technic is its complexity and the demands that it makes for a highly trained organization. One gets the distinct impression that this form of treatment is losing favor and it is not at all uncommon to find interns, recently graduated from our best medical schools, who have never heard of it, or, if so, have never seen it used.

Diametrically opposed to the Carrel-Dakin treatment, we have the advo-

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cates of immediate closure, with or without internal fixation. To Sherman, of Pittsburgh, must be given the credit for the advancement of this practice and in his hands the results seem to have justified his enthusiasm. The disastrous results in the hands of others not so preeminently qualified, however, would lead us to question the safety of recommending it freely and for situations different from those in which his successful results have been achieved.

Between these two extremes we find a great variety of practice. Cotton, writing in Lewis' Surgery, states that débridement, half closure, with drainage by leakage and delay of corrective surgery until later offer the best solution of the problem.

It would appear from this that there is little uniformity of opinion regarding the management of compound fractures. However, surgeons experienced in this type of work agree that all compound fractures are grave surgical emergencies requiring immediate operation. The nature of the surgery required is worthy of the best efforts of the mature surgeon and should not be delegated to inexperienced assistants. There are some who still attempt to differentiate between the fracture that is compounded from within and from without, claiming that the former is a wound made by a sterile instrument not requiring the same extensive exposure and débridement as the latter. We are in absolute disagreement with this point of view and regard it as a matter of academic interest only. It should also be emphasized that the external appearance of a wound is not a reliable criterion by which to judge of its internal extent. In one case, that of a fracture involving the ankle joint, the external wound was not more than an inch in diameter and yet after wide exposure a piece of stocking about three inches square was removed from the interior of the joint. In another case of fracture of the tibia, the external wound was apparently insignificant. A junior member of the department who saw the case reported by telephone that the wound was so slight that he did not feel justified in making a wide exposure, particularly since the fracture was in good position. The wound was disinfected superficially and plaster applied. The result was a virulent infection which nearly cost the patient his leg and his life. The extent of the internal damage disclosed at the second operation was most instructive. The patient fortunately made a good recovery eventually but only after prolonged hospitalization punctuated by repeated operations for the evacuation of pus.

In attempting to rationalize the treatment of compound fractures, Orr has stated four hypotheses upon which he bases his method. These are: (1) The use of antiseptics in the treatment of infected wounds has developed to the point of abuse. (2) It seems that it is not generally known that infected wounds do heal without the application of antiseptics of any kind. (3) Wounds if properly protected will heal consistently without daily dressings or irrigation with antiseptics in a way that is at once easier and better. (4) The important factors in securing these better results are: (a) Primary asepsis or antiseptics when required. (b) Adequate drainage. (c) Immobili-

zation of injured parts. (d) Protection of wounds against disturbance and reinfection.

It should be understood that the Orr method introduces no new principle in the treatment of compound fractures, but merely applies the well established principles of asepsis and immobilization in a somewhat different manner from that formerly recommended.

In the five years that we have been employing this method of treatment we have found it advisable to modify our original technic in some respects. Our present plan is as follows:

After the patient has been anesthetized, and not until then, the temporary splints and dressings are removed. A pad saturated with alcohol is laid over the wound and the entire extremity is shaved and then cleaned with ether and alcohol and painted with tincture of metaphen or iodine. The external wound is then accorded the same preparation.

A careful and systematic mechanical disinfection is then carried out, including excision of the wound margins, removal of all devitalized muscle and completely detached bone. Length and contour are then restored by traction and manipulation. The entire wound is then flooded with ether which often discloses bleeding points otherwise overlooked. The wound is next packed with sterile vaseline gauze, an important part of the operation. The packing should fill the entire wound. It should be placed in contact with the bone; the wound edges should be lifted up and the gauze placed beneath them. The gauze must be thoroughly impregnated with the vaseline and should be reasonably fresh. Gauze which has been repeatedly sterilized tends to become weak and upon removal individual cotton strands may be lost in the granulations and give rise to annoying residual infection of a low grade. Over the pack, vaselized strips of gauze are laid clapboard fashion and an adequate pressure dressing of gauze and cotton is applied. A smooth, snug bandage covers the whole area. The limb is then immobilized by complete circular encasement in plaster of paris. No splitting or fenestration is permissible.

In fractures involving joints, this technic is modified in that the joint cavity, after thorough lavage with ether and particular attention to hemostasis, is closed with interrupted sutures of plain catgut. This plan was adopted in view of the impossibility of maintaining sterility of an open joint after dressings are finally begun. In cases where the joint has been closed we have had no trouble. The rest of the wound is packed as in the ordinary case.

The management from this point on is that of a closed fracture, no dressing being made for at least four weeks. In our earlier cases we kept our patients in the hospital until the first dressing was made. We now keep them in for one week. During the first few days there may be a slight elevation of the temperature ( $100^{\circ}$ – $102^{\circ}$ ) but this need cause no anxiety. It must be remembered that there is usually some temperature reaction following a simple fracture. If at the end of one week the temperature is normal, the patient is allowed to go home, returning in four to six weeks when the plaster case is removed.

In most instances the granulations will have pushed the packing up from the depths of the wound and one finds a clean, red, granulating surface with the bone completely covered. If there is a good firm base of granulation tissue, it is covered at once with pinch grafts. The grafts are covered with paraffin mesh and over this a pressure dressing of either rubber sponge or cotton is placed and held by adhesive strapping. Another plaster case is applied and no further dressing is made until union is complete. If skin grafting is not done at this time, the wound is simply cleansed with ether and covered with vaselined strips of gauze and another case applied. This is the only dressing that is made until complete union has occurred. Occasionally one encounters difficulty with adult patients who become convinced that they are being neglected because they are not dressed. This dissatisfaction is augmented by visitors, who, unhampered by facts or information, regale the patients with gruesome tales of legs lost and so on. A little time spent in explaining the situation often prevents this sort of criticism. To overcome the odor, which is objectionable, various modifications have been suggested regarding the material used to impregnate the gauze pack. It can be helped but not prevented by using a gauze impregnated with both iodoform and vaselin, or by employing bismuth iodoform paste (BIPP). Thymol has also been suggested as a deodorant. The odor, of course, comes not from the wound but from the decomposing secretions in the unchanged dressings. It is a peculiar, highly characteristic smell, alike in all cases, and seems to indicate that the process is due to some specific factor or factors, as in the ripening of the various odoriferous cheeses. The liquefied secretion about the wound is dark, mucilaginous, and non-irritating to the tissues. We have not been able to attribute any of the effects of the treatment to the development of bacteriophage, though this has been suggested. It probably is not a matter of great importance what substance is used as far as the ultimate result is concerned and in the various published reports on this method probably a little too much emphasis has been placed on the vaselined gauze. The important feature is that the mechanically disinfected wound is filled with a bland substance which will allow granulation to proceed and which prevents puddling in a wound covered with an occlusive dressing. We have adhered to the simple yellow vaseline gauze and encouraged the patients to endure the odor.

The convalescence of these patients is in marked contrast to those treated by the more familiar methods that required frequent dressings which not only were a source of dread to the patient, but which of necessity militated against adequate retention of the fracture and imposed the risk of superinfection. Our observations of compound fracture have led to the strong conviction that the suppuration which is so frequently seen is the result of infection introduced at these dressings. The following case is cited to illustrate this point:

CASE REPORT.—S. B., aged 50, a colored man, employed as a stevedore, sustained a compound comminuted fracture of the femur just above the knee joint, when a heavy packing case fell on him. In addition to the fracture of the femur he sustained a fracture



## COMPOUND FRACTURES

of the nose and maxilla and multiple lacerations of the face. He was in profound shock upon admission. The upper fragment of the femur was protruding through his overalls. After instituting measures for the relief of shock, the wound on the outer aspect of the thigh was flooded with iodine and covered with a sterile dressing. During the first 24 hours his condition was such as to warrant nothing beyond temporary extension in a Thomas splint. At the end of this time, under local anesthesia the wound was systematically cleaned out, the protruding bone replaced and the wound packed lightly with iodoform gauze. Tong extension was applied and the limb suspended in a Thomas splint from a Balkan frame in the usual manner. Plaster was not applied. The wound was not dressed and bedside roentgenograms at the end of the fourth day showed that the displacement of the upper fragment had been overcome and although there were 14 fragments present, the alignment was excellent. During the following three weeks the wound was not disturbed by any sort of dressing and the patient had no elevation of temperature. During the fourth week, a new house officer, becoming alarmed by the odor of the dressing, removed the packing, swabbed the wound with mercurochrome and repacked with plain gauze. On the following day the temperature rose sharply to 103° F. and from that point the patient was septic and developed an extensive cellulitis of the thigh which required multiple operations for relief. Union of the fracture, however, occurred but the infection in the depths of the wound prolonged hospitalization for many months.

The objections to the Orr treatment are based largely upon the hesitation almost instinctively aroused in any surgeon's mind as to the danger of encasing a presumably infected wound in plaster, and particularly the danger of anaerobic infection. Experience has demonstrated, however, that this fear is not warranted by the results and *a priori* objections must give way in the presence of facts. In our own case we were led rather easily to give the plan a trial because we had become convinced that prevailing methods, especially that of immediate suture, were dangerous or inadequate especially in wounds potentially contaminated with anaerobic organisms. We had been using with satisfaction open treatment with immobilization and it was not a violent break to employ vaselized gauze as a pack and cover the wound for a longer period.

Anaerobic infection is certainly to be considered in any injury the result of a street or a farm accident and due precautions must be taken against it. While the incidence of tetanus appears to be on the decrease, in the Philadelphia area at least, we are seeing more cases of gas gangrene than formerly. A number of writers have drawn attention to this in the recent literature of gas gangrene in civil practice. Recognizing this danger in all compound fracture cases, whether treated by the Orr method or not, a prophylactic dose of the combined tetanus and gas serum should be given. Before the introduction of the combined serum we employed the two separately, first using the perfringens and later the polyvalent serum. The justification for giving gas or combined serum to these cases has been questioned by some surgeons on the ground that it was unnecessary, although those who question it do not hesitate to give antitetanic serum in all street injuries. It is admitted that in many instances this is an unnecessary precaution but it would seem quite as logical to give the combined serum as antitetanic serum alone.

Others advance the argument that wounds such as commonly accompany compound fractures should be dressed in a manner permitting frequent in-

spection and dressing, in order that proper measures may be applied to the infection which so frequently appears. The answer to this objection is that cases treated by the Orr method do not become infected and that wound infection and osteomyelitis are more often the result of meddlesome dressings than of original contamination.

It must be clearly understood that this method of dressing is not advocated in every case of compound fracture. In our experience it is not satisfactory in femur fractures. The femur lies in the center of a large muscle mass and it is not possible to place the packing in such a way as to prevent puddling in the tissues below and internal to the fracture. In these cases better results are obtained by dakinization combined with some method of suspension and traction. In "stripping" injuries it should not be used unless the wound is very widely opened. In the case seen late and presumably already infected it is usually contra-indicated. On the other hand in old compound fractures with non-union and low grade infection it may be employed with confidence as an adjunct to whatever method of fixation is elected. The following case is illustrative of this point.

CASE REPORT.—E. W., a man, aged 32, was admitted to Abington Hospital in September, 1934, giving a history of having sustained a compound fracture of the tibia seven months before. He had been treated in a fracture box and antiseptic dressings applied to the wound for a week. At the end of that time the fracture was plated and put up in a fenestrated case. Daily dressings were made. Infection, of course, set in, the plate loosened and came off. The attending surgeon then applied a larger plate and repeated the same after treatment with the same result. He then wired the fragments together. During all this time, daily or every other day, the wound was dressed. Finally, the patient was informed that nothing could be done for him and that his leg would probably have to be amputated. As he was a long way from home he elected to sign a release and enter a hospital in his own neighborhood for the operation. On admission he was wearing a fenestrated case. A wound eight inches long and two inches wide, sloughing, dirty and discharging pus was disclosed. In the wound the bone could be seen plainly, about four inches being exposed. The bone looked like a piece of coal, was denuded of periosteum and the fracture, a slightly oblique one, was held in place by a silver wire. There was no evidence of any attempt at callus formation.

Under general anesthesia the wound was excised widely, the wire removed, the ends of the bone freshed and the wound allowed to bleed itself full. When clotting had occurred it was covered with vaseline strips and a plaster case without fenestrations applied from the toes to the mid thigh. No dressing was made for four weeks when the case was removed. The wound was clean and granulations were partially filling it. The bone, however, was not covered at all at the site of the fracture, but was of a better color. A second case was applied and the patient was allowed to go home the next day. Four weeks later, the wound was still clean but the bone was still widely exposed and no union had taken place. Full thickness graft six inches long taken from the opposite tibia was laid in after the Albee technic, the wound packed with vaseline gauze and the limb encased in plaster. In spite of the open and presumably infected field, the graft took and firm union was secured. The patient was dressed only twice during this period following the operation and is now walking with a brace without the aid of crutches. The wound healed nicely by granulation.

The conclusions reached regarding the management of compound fractures are based upon the following experience.

## COMPOUND FRACTURES

In a period of slightly more than five years we treated 203 compound fractures. We exclude those dying of associated injuries. Of these, 106 were treated by the Orr method. Of the 97 treated by other methods, three were partially closed and drained, two were immediately closed, and the remaining 92 were treated by wide open drainage and dakinization or simply by packing and immobilization. In the entire group there were five amputations. Two of these were in cases treated by the Orr method, one of these required amputation because of extensive damage to the blood supply and not on account of infection (amputation should have been performed at the time of the original operation); the other Orr case requiring operation developed generalized gas infection within 24 hours. This was a man with extensive crushing injuries to both the leg and thigh inflicted by a farm tractor. Owing to his condition no débridement could be done and several of the principles of the Orr method were violated. It was realized at the time that the treatment was unsatisfactory but it seemed that nothing else was immediately possible. The three remaining amputations were done as immediate procedures at the time of the first operation. In the entire group there were three deaths. One death was in the case just referred to; the other two occurred 24 and 48 hours after the injury and were due to hemorrhage and shock. With the exception of the two cases of amputation, we have not found it necessary to remove or open a single plaster case for infection. One case was recently removed at the end of a week in order to secure better position of the fracture but the packing was not removed and another encasement applied at once, the patient progressing to an uneventful recovery.

### CONCLUSIONS

In the great majority of compound fractures, the Orr procedure is the method of choice.

The procedure is relatively simple and can be carried out under ordinary hospital conditions.

It is emphasized, however, that the essential conditions must be rigorously fulfilled and inability to meet them *in toto* may call for a complete change of plan.

The chief contraindication to the method, in our opinion, is the existence of extensive devitalizing injuries involving large muscle masses when adequate débridement is impracticable and complete immobilization difficult or impossible.

DISCUSSION.—DR. FREDERIC W. BANCROFT (New York).—Doctor Pfeiffer has brought up a very controversial subject in his paper on the Treatment of Compound Fractures. He has said there are three main methods of treating compound fractures:

(1) Leaving of the wound wide open, after careful débridement and treatment with Carrel-Dakin solution.

(2) Thorough débridement and closure, the closure being either primary or delayed, with the use of some intermediary treatment like Carrel-Dakin until the wound is bacteriologically clear.

## (3) The Orr treatment.

Each one of these methods has its own advocates and each method has shown satisfactory results where good surgery is first performed and the postoperative care has been meticulously carried out. There is no doubt that the individual fitness and inclination of the surgeon, and the equipment and the personnel available for the after care, influence these results.

Doctor Pfeiffer in his summary states that in five years he and Doctor Smyth, Jr., have treated 203 cases of compound fracture: Of these 106 were treated by the Orr method and 97 were treated by other means. Of these 97, 92 cases were treated by wide open drainage and dakinization. I should like to ask Doctor Pfeiffer if the 106 cases treated by the Orr method have been consecutive and the latest cases treated or whether he uses selection in the type of cases. (I assume by his statement that compound fractures of the femur are not treated by the Orr method.) I feel this question is pertinent because it seems to me that there is sufficient good in each method of treatment so that one should not be an advocate of one sole procedure. The type of fracture, the location of the fracture and the amount of contamination that a compound fracture receives must be considered before deciding on the therapy. I do not believe that any one method is applicable to all types of fracture. The initial principles as set down by Orr should be the initial principles of any surgical procedure in the treatment of compound fractures. This means adequate and careful preparation of the skin and wound and adequate and careful débridement of devitalized tissues.

I am thoroughly in accord with Doctor Pfeiffer and many other surgeons that antiseptics are of little value in the treatment of lacerated wounds. I also believe that rough handling in the cleansing of wounds with soap and water and occasionally, as was previously advocated, with a scrubbing brush is also deleterious. Careful, painstaking, non-traumatic cleansing is the most important factor in the prevention of infection.

I must confess that I am astonished at the good results presented by Doctor Pfeiffer in his analysis of cases treated by the Orr method. The absence of infection and the absence of secondary operative procedure reveals good surgery carefully carried out. I also believe that he brings out a point which is very valuable in the early skin grafting of these cases; it unquestionably saves the patient weeks of incapacity and also disfiguring scars. Meleney has shown that one may apply pinch grafts within ten days after the removal of a gangrenous slough due to symbiotic infection. I have often wondered whether or not the odor that arises from the Orr treatment is not an indication of the therapeutic value of the therapy. The odor is said to be due to the action of the hay bacilli and other saprophytic organisms. It is known that if these organisms contaminate a culture medium containing staphylococcus or streptococcus they rapidly overgrow these virulent organisms and cause their destruction. May it not be that the vaseline gauze and the plaster case which cause a good anaerobic medium stimulate the growth of these organisms which digest the offending pathologic bacteria? It has been my impression in treating cases with the Orr method that sometimes dressings are delayed too long for it is noted when they are removed that granulations have penetrated through the meshes of the gauze and considerable trauma is induced in their removal. I can see no harm, after a period of two weeks, in changing the dressing if it seems advisable. I am thoroughly in accord with Doctor Pfeiffer that if this method is started it should be continued through in the same manner unless there is some very strong contraindication. I believe that all of our infected wounds are dressed too often unless treated by the Dakin

## COMPOUND FRACTURES

method, which should be as described by Carrel—a thorough, non-traumatic cleansing.

In acute appendicitis associated with peritonitis it has been my custom for some time to leave the wound wide open and to pack it with vaseline gauze. This gauze is not disturbed for at least five days, assuming that there is no indication of local infection. The packing is then removed and the wound is again dressed with vaseline gauze inserted lightly. This is not disturbed for a similar period, when the wound is frequently almost healed.

I am thoroughly in accord with Doctor Pfeiffer on his treatment of compound femur fractures. Where the bone is so surrounded by deep muscular structures, it is very difficult to properly apply the Orr method, whether it be in compound fractures or osteomyelitis. I believe the results are as much due to good careful surgery as they are to the method applied.

DR. CALVIN M. SMYTH, JR. (Philadelphia).—The statistical matter in this paper perhaps requires a word of explanation. The majority of the cases in which the Orr treatment was not employed were those seen in the early days of our conversion to the method. As Doctor Pfeiffer said we had been for some time employing open drainage or packing combined with fixation and traction so that encasement in plaster was not such a radical change in our practice.

It has always been difficult to understand the reasoning of those who differentiate between the compounding of a fracture from within out and that from without in, and resting the decision as to immediate closure or open drainage upon this. Certainly, once the bone has protruded through the overlying soft parts and come into contact with the outside influences, contamination has necessarily taken place, and, as Doctor Pfeiffer has said, the matter becomes one of academic interest only. Neither can we who practice surgery in general hospitals receiving street accidents follow with confidence a plan which may work perfectly in a hospital which receives only cases from one or two industrial plants where everything is under perfect control and even the accident itself can almost be made to order. It is for this reason that we are so opposed to the practice of immediate closure.

What the Orr method offers is something which can be carried out in any well conducted hospital by any good general surgeon who will take the trouble to become familiar with the technic and follow it faithfully. We have employed it for a sufficient length of time and a wide enough variety of cases to have complete confidence in the method. We have talked about it in Philadelphia for a number of years and yet we still find a hesitancy on the part of our surgical friends to give it a trial. Curiously enough the most violent objectors to the Orr plan of treatment are found, not among the advocates of open methods, but among those who favor immediate and complete closure, and yet the objection that one hears most is that it is unsafe to leave these patients alone for four or five weeks. It was in the hope that more surgeons might be persuaded to convince themselves regarding the true worth of the procedure that this paper is presented today.

DR. DAMON B. PFEIFFER (Philadelphia).—I hope no one detected a beligerent note in our presentation of this paper, but if so, it comes perhaps from the fact that in spite of our intensity of feeling as to the merits of this method, we have been unable to secure anything like general approval or adoption in Philadelphia.

We presented this paper because we believe thoroughly that the method is a great advance in the treatment of compound fractures. There are three striking things that anyone who has followed this treatment will notice.



In the first place, the uniformity of healing without infection. No other plan with which I am familiar gives us the same security against infection as this procedure.

Second, the strikingly clean and excellent appearance of the granulations which cover bone and soft tissues on removal of the pack.

Third, the rapidity and uniformity with which union occurs in the lower third of the tibia, which is notoriously a site for slow union or non-union. We have yet to have an instance of non-union. As a general rule, union occurs much more rapidly than in ordinary closed fractures.

I have been stimulated to think about the reasons for the efficacy of this treatment, in the first place, because of the incredulity, if I may speak of it, of my colleagues, and in the second place, because one is naturally led to inquire about a phenomenon which is so impressive.

It seems to me, after all, the explanation is quite simple. All of our surgical wounds are contaminated. As surgeons, we must realize that bacteriologic asepsis is a very different thing from surgical asepsis. A Petri dish by the side of your operating table will soon convince you of that fact and while most of the organisms are saprophytes, some have pathogenic possibilities. We actually deal therefore with a dosage of infection, the amount of contamination. We rely upon such factors as blood supply, avoidance of puddling, dead spaces, avoidance of trauma, and we have come to regard our wounds inflicted under aseptic conditions as aseptic because they seem to heal aseptically.

These compound fracture wounds are practically never aseptic, but we reproduce, so far as I can see it in this method, the conditions of a wound inflicted under aseptic conditions. In other words, by débridement, we cut down the amount of infection. By introducing a pack impregnated with vaseline gauze, we prevent the pack from becoming a plug at once so that serum and blood can ooze out and in a very few hours every particle of that wound comes in contact with vaselinized gauze. All crevices are obliterated and complete immobilization is effected.

You have such organisms as are there imprisoned between the gauze and tissues, and the plight of a single or a few organisms in that situation, beset by the serologic and cellular forces of immunity, must be desperate. The wound thus completes its own sterilization. Every little while we have to rediscover the healing powers of nature, and this, I think, is what we are doing in this particular procedure.

# BRIEF COMMUNICATIONS AND CASE REPORTS

## THE HYPOPHYSIS AND BODY METABOLISM\*

JOSHUA E. SWEET, M.D.

NEW YORK

THE speaker outlined the work now being carried forward at Cornell on the subject of the hypophysis, stating that he presented his first work on this gland before the Philadelphia Academy of Surgery 22 years ago.<sup>1</sup> During this interval it would seem that progress had perhaps been too rapid, when five different hormones have been described as taking origin from two groups of cells; and when a control by this gland is suspected over the four great classes of metabolic activity—fats, proteins, carbohydrates and water—making nine hormones in all. Small wonder that such a control center of the basis of life should be placed in the most inaccessible position of the entire body!

Not only has thinking about the hypophysis become intolerably complex—to these eight or ten hormones is now to be added the concept of separate antihormones—but methods of research have become increasingly difficult, as science advances farther from its old base of supplies, which is still direct observation by the five senses.

In the Department of Physiology at Cornell is one of the few animal calorimeters in existence and with the aid of this machine Doctor Chambers has been studying the problem. The animal is studied day after day, under conditions controlled in respect to all phases of metabolic activity. As a result several definite ideas have thus far been formed, namely:

(1) After removal of the hypophysis the blood sugar is lowered, and convulsions may occur; but these are not because of the low blood sugar.

(2) The animal becomes extremely sensitive to insulin, 1/80 of a unit per kilo being as effective intravenously as 1/4 of a unit in a control animal.

(3) This is not because the pancreas contains more insulin than normal, since the operated animal's pancreas contains only the normal amount.

(4) The belief is growing that the pituitary must be concerned with a process fundamental to general ductless gland action, perhaps with the elaboration of a common mother substance.

A second method of approach to the problem is being attempted by Doctors Richardson and Shorr of the Department of Medicine, who are experts in methods of studying the metabolism of isolated tissues. This work,

\* Read before the Joint Meeting of the New York Surgical Society and the Philadelphia Academy of Surgery, February 13, 1935.

though not advanced sufficiently to report results, suggests that the isolated muscle, after combined hypophysectomy and pancreatectomy, is as diabetic as after pancreatectomy alone, even while the entire animal seems less diabetic.

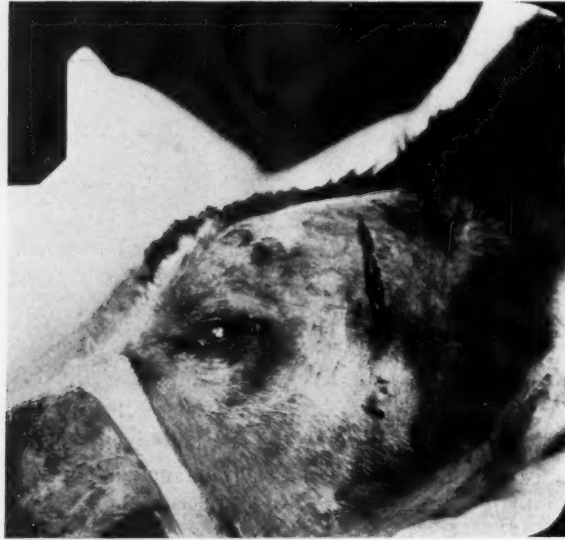


FIG. 1.—Location and extent of skin incision.

A third method in use, and an extremely interesting one, is that which Doctor Anderson of the Department of Anatomy is using in a study of the effect of the loss of specific gland functions upon the conditioned reflexes, using the salivary reflex of Pawlow, and also a conditioned motor reflex.

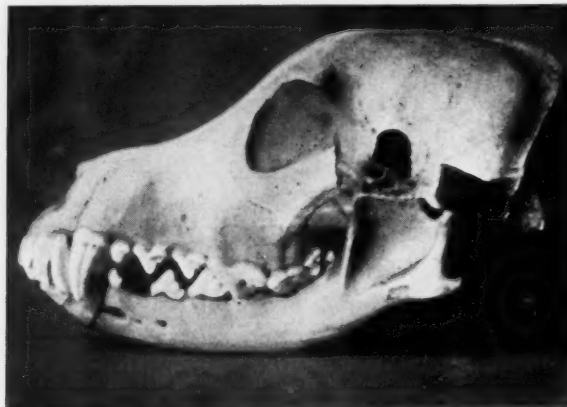


FIG. 2.—Zygomatic arch and coronoid process of mandible resected, skull trephined.

This method appears to be a sensitive one; an animal without the thyroid completely loses the reflex; it can be restored by thyroid medication, to be lost again on withholding treatment. It seems also to disappear after hypophysectomy, but the effect of medication upon these animals is not yet known.

When complicated and time consuming methods are used, the problem presented to the surgeon becomes somewhat different from what it was with less laborious methods of study. In the first place, the surgeon must do as little harm as possible—a concept fundamental to all surgery but not always sufficiently emphasized—and if an animal is to be studied for weeks or months it becomes of vital importance that the experimenter may know at the time of operation just what happened, not have to wait until serial sections of the brain base may disclose, after weeks of labor, that the gland was incompletely removed. Doctor Sweet said that this was his special problem and thought it might be of interest to surgeons to see how it has been successfully met.

The method of approach to the pituitary is the same as was previously described<sup>1</sup> (Fig. 1). An incision about two inches in length is made perpendicularly over the zygoma. The zygomatic arch is removed by sub-

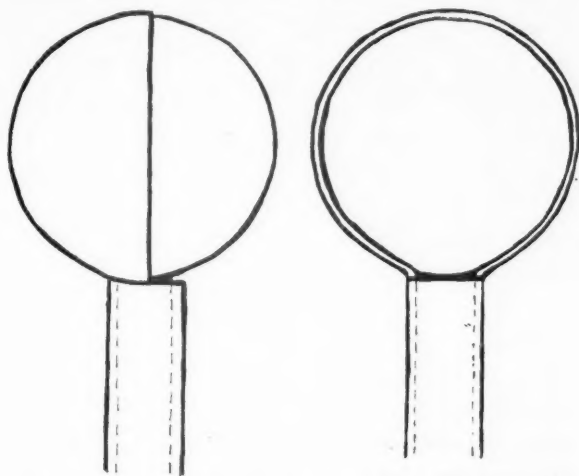


FIG. 3.—Schematic drawing of double spoon.

periosteal resection. The coronoid process of the mandible is resected and the skull approached in a direct line, as near as possible to the base. The skull is trephined and the hole somewhat enlarged (Fig. 2). The dura is removed and the brain slightly elevated by a suitable retractor, the best retractor in his experience having a short blade with carefully rounded edges, fastened to the end of a bronchoscopic light carrier. An adjustable hand piece is attached to the retractor for ease in holding (Fig. 4). The removal of the hypophysis is accomplished with the aid of a double spoon or curette (Fig. 3). A hemispherical spoon of proper size to hold the pituitary is fitted to a slightly larger spoon which revolves over the inner spoon. With the device open it is gently introduced above and posterior to the gland; the edge of the spoon is then inserted underneath the pituitary, thus severing the attachments of the posterior lobe, and is turned so that the gland lies within the inner spoon. While the operator holds it in this position the assistant rotates

the outer spoon, severing the stalk and permitting the withdrawal of the gland intact and *in toto*. Figure 4 shows the retractor, the double spoon closed, and in the middle a single spoon which is sometimes used to free the attachments of the posterior lobe.

The main object of the procedure—to enable the operator to demonstrate at the close of the operation whether the gland has been completely removed—is thus successfully met.

## REFERENCE

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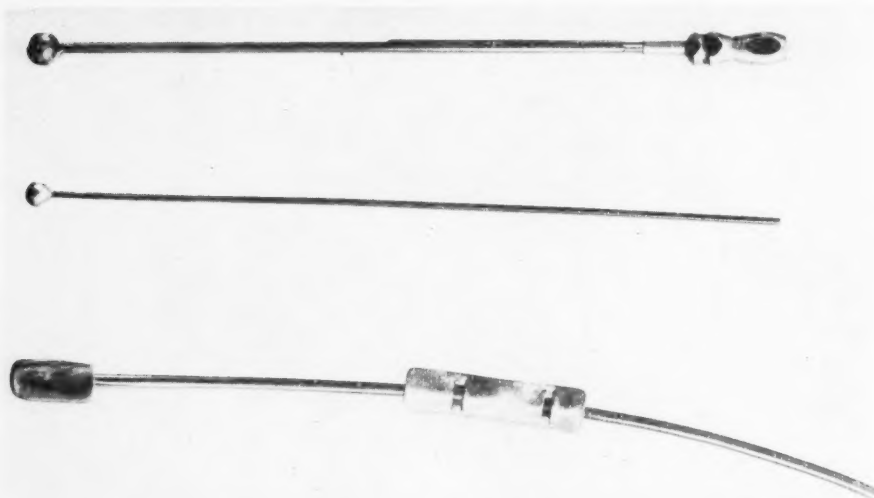


FIG. 4.—The double spoon. A single spoon. The lighted retractor.

DISCUSSION.—DR. ISIDOR S. RAVDIN (Philadelphia) felt that although developments in the field of pituitary physiology may have been too rapid, nevertheless it is to be assumed that with the method developed by Doctor Sweet and the group now associated with him, advancement will be even more rapid than in the past.

Houssay and his associates have demonstrated clearly the relationship between the pituitary, adrenals, and pancreas, and have shown clearly the complexity of the problem of carbohydrate metabolism. Recently, Long and Lukens have made noteworthy contributions and the recent studies of Fluch, Greiner and Loewi have added considerably to this field, the foundation of which was laid by Cushing.

Emery and Atwell have demonstrated that the injection of an extract of the whole pituitary results in a marked increase in the weight of the adrenals and similarly it has been shown that hypophysectomy causes a decrease in the weight of the adrenals and thyroid.

Melville and Holman have shown that the diuretic action of the posterior



lobe extract is in the pressor fraction, the oxytocic fraction having a diuretic action only 5 per cent as great as the pressor fraction. Black, Collip and Thompson demonstrated that suitable anterior pituitary extracts greatly increase the acetonuria in rats. This ketogenic principle is not identical with the thyreotropic, adrenotropic or the growth hormone.

The recent experiments of Targow confirm and extend the earlier investigations of Evans and others in that they show that the growth promoting extract of the anterior lobe causes (1) a decrease in the weight of the pituitary gland; (2) an increase in the nose-anus length; (3) an increase in the weight of the heart, lungs and kidneys; and (4) an increase in the water content of the skin and kidneys.

The close relation of the pituitary with the thyroid has been amply demonstrated. Any gland that has (1) pressor; (2) oxytocic; (3) growth stimulating; (4) thyreotropic; (5) adrenotropic; (6) gonadotropic; and (7) diuretic substance and perhaps others with which we are not as yet familiar, justly deserves the extensive series of studies which Doctor Sweet and his associates propose.

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### ANTERIOR SPINAL NERVE ROOT SECTION\*

#### A SURGICAL TREATMENT OF ESSENTIAL HYPERTENSION

GEORGE J. HEUER, M.D.

NEW YORK

ESSENTIAL hypertension is a disease as yet not clearly understood, the medical treatment of which has thus far proven unsatisfactory. In view of the tragic future to which individuals affected with this disease must look it had seemed proper to approach its treatment by the more radical methods of surgery. Dr. Irving H. Page of the Hospital of the Rockefeller Institute for Medical Research and Doctor Heuer had been interested in these surgical methods for some time. He wished to refer to only one surgical method in the treatment of this disease—that of anterior spinal nerve root section.

This procedure is based in part upon the physiologic observations of J. Rose Bradford published in 1889 to the effect that stimulation of the anterior roots of the spinal nerves from the sixth dorsal to the second lumbar causes a rise in blood pressure and contraction of the kidney, the greatest result being obtained by stimulation of the anterior roots of the tenth dorsal to the first lumbar. This and other evidence would indicate that the arterioles of the splanchnic area are constricted in patients with essential hypertension and that more or less maintained vasoconstriction may be an important factor in keeping the pressure at a high level. Interruption, by surgical

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\* Read before the Joint Meeting of the New York Surgical Society and the Philadelphia Academy of Surgery, February 13, 1935.

means, of nerves carrying effector impulses to this area would, therefore, appear to be a logical therapeutic measure.

The operation consists in the division of the anterior roots of the spinal nerves within the field covered by the sixth dorsal to the second lumbar. In only one instance were all the anterior nerve roots divided from the sixth dorsal to the second lumbar. In the remaining cases, a lesser number were divided (Table I).

TABLE I

Patient	Initial Blood Pressure	Postoperative Blood Pressure		Roots Sectioned
		1 mo. P.O.	3 or more mos. P.O.	
I. S. (63717).....	192/120	130/82	124/92	6 T- 2 L
R. H. (82044).....	180/118	136/90	122/80	9 T- 1 L
B. H. (80474).....	218/138	146/94	140/92	9 T- 1 L
P. S. (78618).....	200/118	140/100	142/100	9 T- 1 L
A. S. (78647).....	220/144	120/80	144/94	9 T- 1 L
A. R. (84842).....	220/130	120/82	..	8 T-12 T
F. S. (85648).....	210/124	160/105	..	7 T-12 T
J. A. (80439)*.....	240/160	230/120	246/140	9 T-12 T
F. D. (68407)†.....	240/160			

\* Died four months after operation.

† Died at end of operation.

A laminectomy is done, the dura opened and the anterior nerve roots exposed by gentle rotation of the cord. Each pair of nerves is divided between ligatures of fine silk. The operation, a delicate procedure, must be performed with great attention to detail.

The first operation of this nature performed by Doctors Heuer and Page was on May 11, 1934. At that time only one case operated upon by this method had been reported, that of Adson and Brown. Their result led to the selection of patients for operation who, so far as could be determined, did not have structural changes in their blood vessels.

Thus far in this series nine patients have been operated upon. Two had advanced disease and did not conform to the postulate that cases selected for operation should be early cases. One, a serious surgical risk, died at the completion of the operation. The second, also a serious risk with advanced disease, did so badly that the operation was abandoned after the division of the ninth to the twelfth thoracic nerves. His blood pressure was not affected following operation and he died four months later from his disease. The remaining seven patients have done well and their blood pressures have been reduced to normal or almost so (Table I).

The disabilities to be expected after operation thus far have not been serious. The difficulty in evacuating the bladder and bowel observed within 24 to 48 hours after operation promptly disappeared. The paralysis of the abdominal muscles apparently has been of little consequence, and other

demonstrable changes the result of root section have not affected the patients detrimentally.

DISCUSSION.—DR. FRANCIS C. GRANT (Philadelphia) said that his experience with surgical methods for reducing hypertension had been limited to a single case. When the Neurosurgical Society met at Ann Arbor in 1934 Doctor Peet, who, with Doctor Kahn had been attacking this problem, reported success with section of the middle and lesser splanchnic nerves. This procedure appealed to Doctor Grant more than the operation described by Doctor Heuer. Laminectomy he felt to be objectionable, first on the ground of magnitude, and also for the reason that the roots are tied off without separating them from the very fine anterior spinal blood vessels that run with them, so that interference with the blood supply of the cord may result in a paraplegia. In one of the first cases in which laminectomy and anterior root section was performed at the Mayo clinic, partial paraplegia did follow.

#### CASE REPORT

About a year ago a colored man, 40 years of age, was admitted to the Graduate Hospital, Philadelphia, suffering from headache and loss of vision. His blood pressure was 240/190. He had a choked disk of four diopters but no localizing neurologic symptoms. The urine was entirely negative and the blood urea within normal limits. He was moderately arteriosclerotic. We had no suggestions to make regarding treatment unless he would permit section of his splanchnic nerves. He consented, whereupon the tenth rib on the left side was resected, the middle and lesser splanchnic nerves were sectioned and also his thoracic sympathetic chain including the ninth, tenth and eleventh ganglia.

The result was rather striking. After ten days' preoperative rest in bed, during which time the blood pressure fell to 190/140, after operation to 130/100, averaging 140/100 for three weeks, at one point it fell to 110/85. An empyema then developed, during which the blood pressure rose at one time to 170/140, but following evacuation of the pus it fell again. During the four months since then it has maintained a level of 120 to 140/90. The Fishberg test has remained entirely negative, the blood urea has been within normal limits and urinary concentration has been maintained. The patient's headache was completely relieved during the first ten days following operation and recession of the choked disk, which began two weeks after operation, was complete within six weeks.

At the follow up clinic March 9, 1935, one year postoperative, his blood pressure was 180/130. He no longer had headache and there was no choking of the disks. A routine urinary examination was negative. Specific gravity 1.020, no albumin and no casts. It would seem, therefore, that reduction in the blood pressure following section of splanchnic nerves and thoracic sympathetic chain from the ninth to the twelfth ganglia on the left side—only temporarily effected a reduction of blood pressure. However, the headache has been relieved, the disks have remained flat and as yet there are no urinary findings suggesting the presence of chronic nephritis.

Doctor Grant said he had no explanation to offer for the effect of this operative procedure. Doctor Fay at Temple University has produced evidence to suggest that the blood pressure control mechanism is situated somewhere between the eighth to the eleventh thoracic segments. It is the sympathetic pathways from these particular segments that are sectioned together

with the middle and lesser splanchnic nerves. If further experience confirms the reduction in blood pressure produced by this operation in this case, the surgical procedure is certainly easier than the extensive laminectomy advocated by Doctor Heuer. Doctor Peet has reported six cases, in four of whom the operation was successful, with improvement in the two remaining instances.

## LOBECTOMY FOR BRONCHIECTASIS \*

### REPORT OF FOUR CASES IN CHILDREN

JOHN V. BOHRER, M.D.

NEW YORK

THE children presented were admitted to the Bellevue Medical Service for Children where they not only had a diagnostic "work up," but were treated by all conservative means including bed rest, long periods of postural and bronchoscopic drainage. Their symptoms were ameliorated but there was no abatement or retrogression of the lesions. Radical procedure for the removal of the diseased portion of the lung was determined upon.

All four patients gave a history of frequent recurrent pneumonia. All had profuse, malodorous, mucopurulent expectoration, the amounts varying from a few ounces up to 30 ounces in 24 hours. Loss of appetite and sleeplessness were general complaints. Ostracism from school and society was complained of by both patients and parents.

Two of the children had developed empyema following attacks of pneumonia, and both had been operated upon for this complication. The third patient had a definite lung abscess following a tonsillectomy and the fourth had spent two years in a tubercular sanatorium for "lung trouble."

Physically all were underdeveloped, anemic and apparently chronically ill. All had clubbing of the fingers in varying degree. Various physical signs could be elicited by auscultation of the chest, depending upon the amount of retained secretion at the time of examination. All were bronchoscoped and mucus aspirated from the main bronchus of the lobes involved. No foreign bodies were found in the bronchi during bronchoscopy. Roentgen ray examination revealed fibrosis of the involved lobes with a tendency of the mediastinum to shift toward the involved side.

### CASE REPORTS

CASE I.—A. B., a boy of nine years, was operated on February 10, 1932. Due to numerous preceding illnesses, including an attack of acute hemorrhagic nephritis, he was a poor operative risk. His left lower lobe, which was to be removed, was found adherent to the chest wall, diaphragm, pericardium, and to the upper lobe. It was bluish black in color, small in size, and atelectatic. The operation was done in two stages. The postoperative course was stormy, and included an attack of scarlet fever,

\* Presented before the Joint Meeting of the New York Surgical Society and the Philadelphia Academy of Surgery, February 13, 1935.

## LOBECTOMY FOR BRONCHIECTASIS

but at no time was the patient in a serious surgical condition. Since his discharge from the hospital he has been cough and sputum free, has developed normally, and his general health is much improved. The clubbing of the fingers has not resolved and he has had one attack of nephritis.

In 1934 he was readmitted to the hospital on account of a small sinus in the middle of his scar which proved to be a bronchocutaneous fistula, developing two years after operation. A muscle plasty operation was done, the fistula has remained closed and the patient is in good health.

CASE II.—F. I., a boy of seven years, was operated upon October 1, 1932. A lung abscess of the right middle lobe following tonsillectomy was the origin of his bronchiectasis, which invaded the entire middle and a portion of the lower lobe.

The two lower lobes were removed *en masse* in a two stage operation. He has remained well since his discharge from the hospital, developing normally in every way, and is able to attend a general school. His chest shows no clinical deformity.

CASE III.—F. A., a girl of 11 years, was operated upon by a two stage lobectomy January 10, 1934. She had large multiple bronchiectatic abscesses of the left lower lobe and would expectorate 30 ounces of sputum in 24 hours. Her temperature ranged between normal and 101°, regardless of bed rest, postural and bronchoscopic drainage, which increased the hazard of lobectomy. After freeing the lower lobe from adhesions, her condition would not permit further surgery, thus necessitating a two stage operation. During a 19 day interval, adhesions reformed and were so dense that at operation only two-thirds of the lobe could be freed. This portion was resected and the balance removed by the use of actual cautery. A bronchocutaneous fistula formed, which has been kept open and is draining considerable mucoid material. The patient is now in excellent physical condition and is cough and sputum free. She is to be operated on again for removal of the small portion of diseased lung that is apparently responsible for the present discharging fistula. Cautery pneumonectomy has not proven very satisfactory in this case, and obviously should be used only when other means of removal are impossible.

CASE IV.—H. S., a girl of 11 years, was operated on April 10, 1934, for a left lower lobectomy. The entire lung was involved and a pneumonectomy was contemplated. However, since the greatest involvement was confined to the lower lobe, it was removed in a one stage operation. (The remaining lobe is to be removed at a later period.) Her convalescence was short and uneventful. She has become cough and sputum free, and for this reason the upper lobe has not as yet been removed. She is in excellent condition.

Lobectomy is a radical procedure and, of necessity, has considerable mortality, although these four consecutive cases have survived. It is not advocated for all cases of bronchiectasis in children but should be considered in cases with extensive pathology where most of the lung tissue has been destroyed, leaving only a shrunken, fibrosed portion of lung composed of dilated bronchi and multiple bronchiectatic abscesses. If early diagnosis of bronchiectasis can be made and if cases tending to retrogress be differentiated with certainty from those that tend to progress, the operation may be done before adhesions form and before the general condition of the patient deteriorates as the result of long suppuration. This would greatly reduce the mortality.

Many more lobectomies have been done on adult patients than on children, although 50 per cent of the adult patients date the genesis of their disease to childhood. This procrastination is not justified because:



- (1) Children withstand the shock of lobectomy as well as, or better than adults.
- (2) The tissues are more elastic during childhood.
- (3) Due to growth, the anatomic deformities caused by the operation are reduced.
- (4) Many patients die from the disease before reaching adult life.
- (5) The disease often becomes more extensive, both by extension to other lobes and by the formation of adhesions to surrounding viscera.
- (6) By curing the disease, these little patients are no longer ostracized from school and society.

DISCUSSION.—DR. GEORGE P. MULLER (Philadelphia) demonstrated two extremes in the technical procedure of lobectomy by referring to two cases. The first was a child of six years who at the age of two and one-half years aspirated a peanut following which he had chest pain and cough. Doctor Clerf removed the foreign body through the bronchoscope and the child remained well except for some cough until 14 months ago when he had an attack of measles, after which symptoms became more severe and he had expectoration and hemoptysis. He was treated bronchoscopically by Doctor Clerf, but early in December it was decided a lobectomy would be necessary. Doctor Muller operated in January, removing the left lower lobe. This was done in one stage through a posterior incision, using avertin and nitrous oxide-oxygen anesthesia. A small catheter was introduced through a lower separate stab and attached to a low pressure suction machine. There were so few adhesions at the approach to the hilus that this was quite easy, and as it was possible, by increased pressure in the mask, to blow the lung down there seemed no reason not to conclude the operation in one stage. The child made a perfect recovery. Roentgenograms show that the upper lobe completely fills the left chest. This represents the ideal case: bronchiectasis of one lobe treated by careful palliative measures and then by lobectomy in one stage followed by perfect healing.

Of an entirely different type is the story of a girl 12 years old who had an empyema that was operated upon several times before she was seen by the speaker. A small bronchial fistula was present and she was coughing with profuse expectoration. Because there was multiple cavitation as well as bronchiectasis, operation was begun with the intention of doing a Graham cautery excision. However, after exposure, it seemed proper to remove the lower lobe, which was done. Unfortunately, the disease was also in the middle and perhaps in the base of the upper lobe. Consequently, while the child improved greatly clinically, nevertheless lipiodol injection shows that she has a large degree of bronchiectasis in the parts mentioned. Therefore, there remains nothing other than total removal, or removal of the middle and part of the upper lobe.

## MULTIPLE CARCINOMATA OF THE COLON

### MULTIPLE CARCINOMATA OF THE COLON \*

PARTIAL COLECTOMY FOR CARCINOMA OF THE TRANSVERSE COLON (1920);  
OF THE SIGMOID (1926) AND OF THE ASCENDING COLON (1934)

PERCY KLINGENSTEIN, M.D.

NEW YORK

CASE REPORT.—A female, 43 years of age, was first treated 15 years ago at the age of 28 because of vague, right, lower abdominal pain, occasionally located in the right flank, which bore no relation to meals and was generally unattended by other symptoms referable to the gastro-intestinal tract. There was no nausea, vomiting or diarrhea. On physical examination a movable kidney could be palpated and the late Dr. A. V. Moschcowitz, who thought her symptoms could be ascribed to chronic appendicitis, decided to do a nephropexy and through the same incision explore the appendix. Under gas-oxygen-ether anesthesia an abdominal exploration revealed the presence of a mass in the region of the transverse colon. Through a separate abdominal incision this mass was found to consist of an intrinsic neoplasm of the colon and was

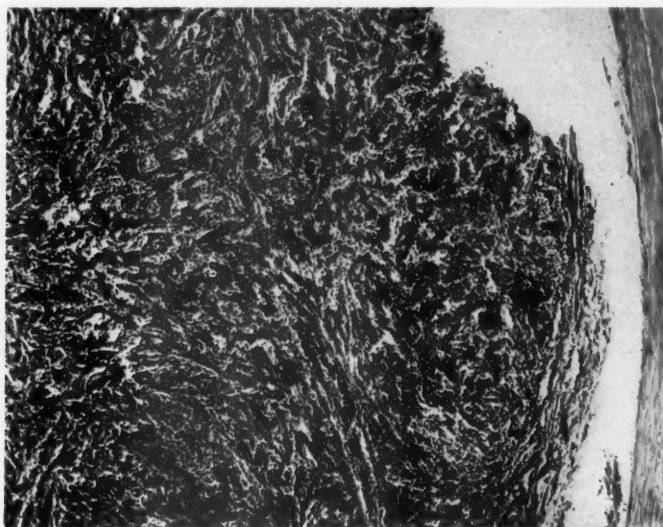


FIG. 1.—Photomicrograph of adenocarcinoma removed from transverse colon, 1920.

accordingly resected with an end-to-end anastomosis. The patient made an uneventful recovery. The specimen removed consisted of a portion of the large intestine, measuring about 10 cm. in length, and presented an ulcerated carcinoma occupying the entire circumference of the gut. The tumor presented a heaped-up cauliflower margin with its center ulcerated and necrotic. The gross and microscopic diagnosis was adenocarcinoma (Fig. 1).

The patient was entirely symptom free until five years later (1925) when she was readmitted to Mt. Sinai Hospital with a history of dull, left lower abdominal pain, attended by some weight loss. Physical examination was entirely negative except for evidences of her previous laparotomy and nephropexy. A vague mass could be felt on vaginal examination in the left fornix and was interpreted as either ovarian or sigmoidal in origin. Proctoscopy with biopsy was reported as showing necrotic colloid

\* Presented before the Joint Meeting of the New York Surgical Society and the Philadelphia Academy of Surgery, February 13, 1935.

material and rectal mucosa containing pigment but with no distinct evidence of neoplasm. Exploratory laparotomy again by Doctor Moschowitz through a left, lower, muscle splitting incision under the presumptive diagnosis of either an ovarian or sigmoidal

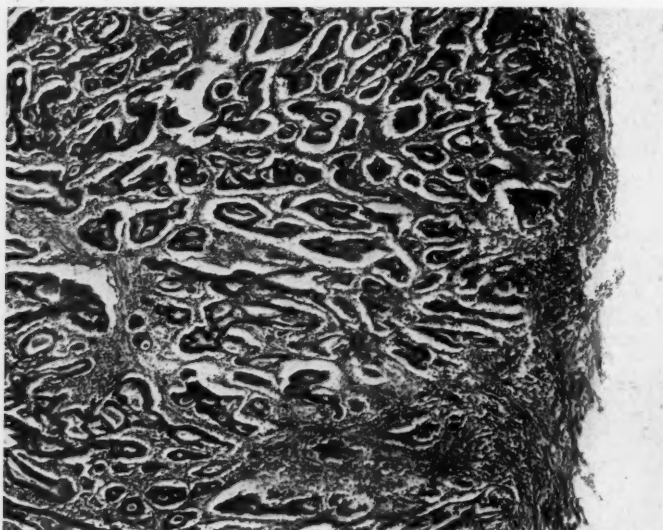


FIG. 2.—Photomicrograph of adenocarcinoma of sigmoid resected in 1925.

mass revealed a firm tumor involving the upper portion of the sigmoid flexure of the colon. Further exploration showed no liver metastases and palpation of the transverse colon region was negative. A resection of the involved flexure was done between

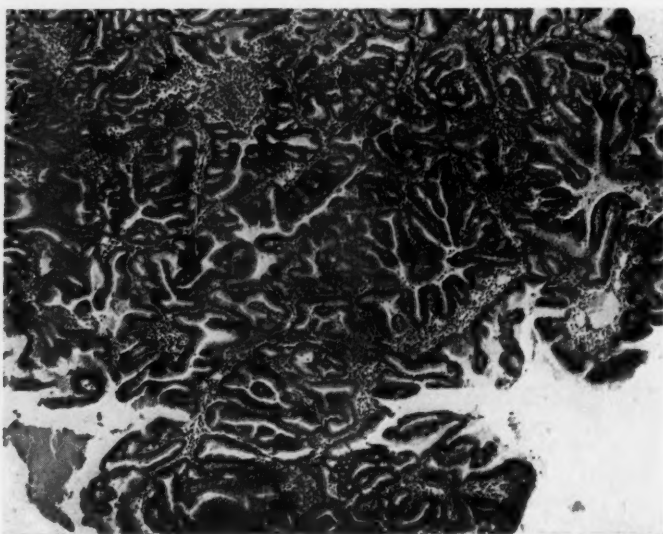


FIG. 3.—Photomicrograph of adenocarcinoma of uterus, 1928.

clamps and an end-to-end anastomosis established, with drainage. Her postoperative course was complicated and prolonged by a fecal fistula and a pelvic exudate. She was discharged, well, one month and a half after operation. The resected specimen of sigmoid was 6 cm. in length. The entire wall of the sigmoid was involved in an annular

## MULTIPLE CARCINOMATA OF THE COLON

growth and the serosa was scarred and puckered. On section, it presented a rather flat, papillary growth about 5 cm. in diameter occupying the entire circumference of the bowel. The intestinal wall beyond the tumor presented a peculiar, pigmented condition. The attached portion of the mesosigmoid contained a few small lymph nodes. Pathologic diagnosis was adenocarcinoma without lymph node involvement (Fig. 2).

Three years later (1928), she was readmitted to Mt. Sinai Hospital on the service of Dr. Robert T. Frank for irregular uterine bleeding of six weeks' duration. Abdominal examination was negative. Vaginal examination disclosed a large, firm, and slightly irregular uterus which was retroflexed. Diagnostic curettage revealed the presence of an adenocarcinoma of the uterus (Fig. 3). A complete hysterectomy and bilateral salpingo-oophorectomy was done by Doctor Frank. A small area in the right fundal

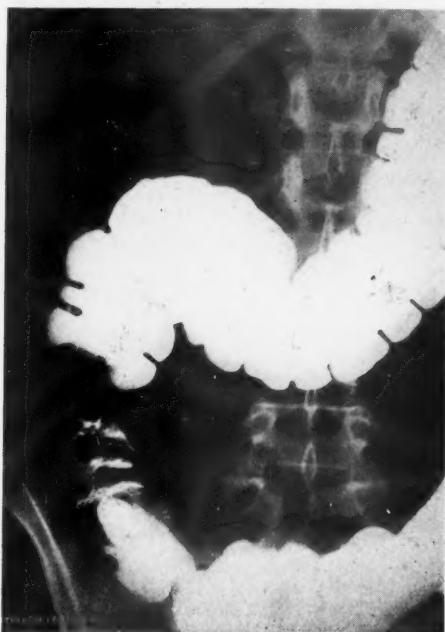


FIG. 4.



FIG. 5.

FIG. 4.—Barium enema showing filling defect in ascending colon.

FIG. 5.—Photograph of resected colon (1934) showing melanosis of mucous membrane. The carcinoma stands out as the white object in the dark background. Not all of the resected colon is included in this photograph.

wall was the seat of the malignancy. There was no evidence at this time of any recurrence in the sigmoid. The patient made an uneventful convalescence and was discharged 21 days after admission.

She was perfectly well for a six year interval and consulted me in January, 1934, for a very minor surgical condition. Interested in her previous surgical experiences, on inquiry she admitted reluctantly that again she had had some vague abdominal pain, fleeting in nature and not very severe, for the previous three weeks. Examination revealed some tenderness in the right lower quadrant and the vague suggestion of a mass. Barium enema revealed the presence of a filling defect in the midascending colon (Fig. 4).

Pelvic and rectal examinations were entirely negative and the patient was again advised operation. She was readmitted to Mt. Sinai Hospital on the service of Dr. Richard Lewisohn and operated upon by me. Under general anesthesia, through a right midrectus incision, a stenosing, circular, carcinomatous lesion of the ascending

colon was found. The adhesions, as the result of previous laparotomies, were dense. Palpation of the pelvis and liver were negative. An ileocolic resection of the terminal ileum, ascending colon, and a large portion of the transverse colon, almost to the splenic flexure, was done with side-to-side suture ileocolostomy. A larger portion of the transverse colon was resected than would ordinarily have been necessary because of the vascular arrangement which was irregularly disturbed by the previous resection in this area. Patient made an uneventful convalescence.

The specimen consisted of a small piece of terminal ileum and 25 cm. of cecum, ascending, and a portion of the transverse colon (Fig. 5). At a point in the ascending colon, 5 cm. from the ileocecal valve, there was present an annular, constricting, infiltrating, granular, hard, necrotic tumor, measuring 3 cm. in length along the longitudinal aspect of the gut, necrotic in its center, infiltrating all the coats of the intestine at this point, and invading the fat around it. The mucosa of the entire portion of the resected colon had a greenish black appearance. The mucosa was freely movable except

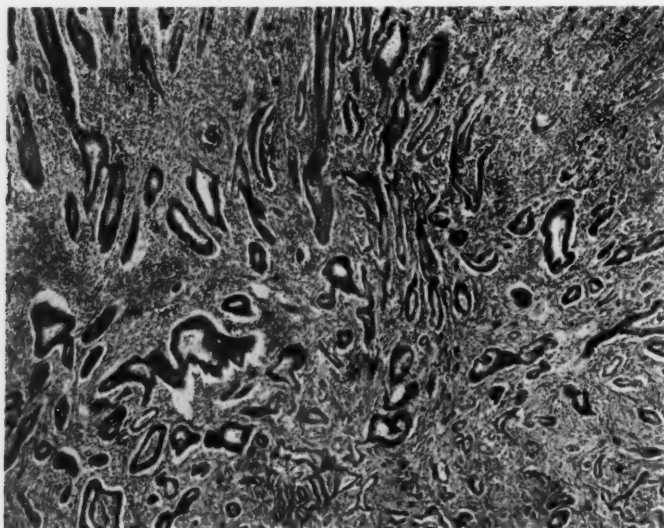


FIG. 6.—Photomicrograph of adenocarcinoma of ascending colon resected in 1934.

over the region of the tumor described. There were many nodes in the mesentery which appeared enlarged. Melanosis appeared universally in the part of the intestine resected except in the ileum and the portion of the colon that was involved by the carcinoma. Pathologic report: adenocarcinoma and melanosis of the colon (Fig. 6). Lymph nodes uninvolved.

The patient made an uneventful recovery. It is now one year since her last operation and 15 years since her first of the series of intestinal resections. Barium enema, one week ago, showed a normally functioning stoma with a normally outlined colon up to the point of resection (Fig. 7).

I shall not discuss, because of time limitation, the fascinating subject of multiple, primary, malignant new growths in the same patient because, whether we hold the colonic neoplasms successively removed to be all primary tumors or not, the patient presents, in addition, an independent new growth of an entirely different organ.

A cursory review of the literature shows that multiple carcinomata of



## MULTIPLE CARCINOMATA OF THE COLON

the gastro-intestinal tract, while far from rare (169 cases were collected by Warren and Gates<sup>1</sup>), only 29 of these are limited to the colon. Barga and Rankin<sup>2</sup> contribute the largest group of cases in the literature. One of these corresponds closely to the patient under discussion. A cancer of the ascending colon was resected in 1920; in 1926, carcinoma of the sigmoid was resected; in 1929, a third growth was found in the splenic flexure and removed, while in the same year hysterectomy was done for sarcoma of the uterus. Dowden<sup>3</sup> (1917) reported a case in which four metachronous cancers of the colon developed in six years. Lilienthal<sup>4</sup> has recorded a case in which the subsequent tumor developed 20 years after the extirpation of the first and

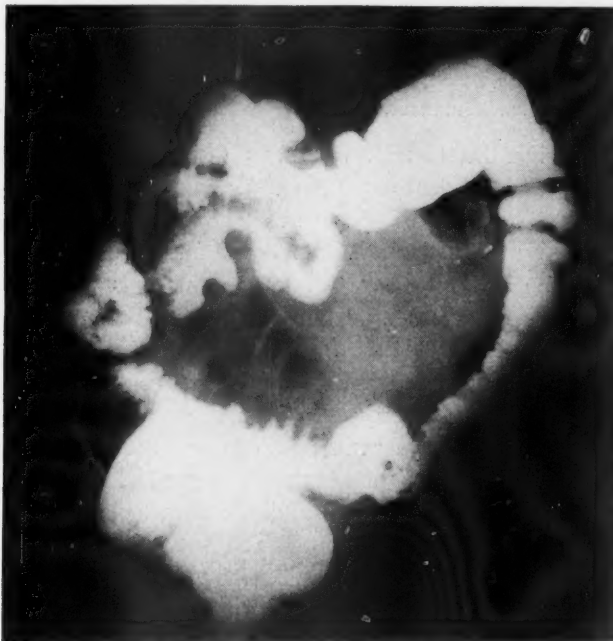


FIG. 7.—Barium enema taken in 1935 showing a normal colon up to the point of resection and a normally functioning stoma.

in an entirely remote portion of the colon. At Mt. Sinai Hospital, we have encountered a number of synchronous carcinomata of the colon. Doctor Lewisohn<sup>5</sup> reoperated upon a patient six years after the first colonic tumor was excised for an apparently independent new growth.

That preexisting adenomatous polyposis is a very definite etiologic factor in the development of multiple colonic cancers is known. There is no evidence that this etiologic factor is present in this case. When two or more cancers are found in the intestine the first and most obvious explanation is that one is the primary growth and the others are secondary implantations. This argument is not always admissible because either the most distal growth is the oldest or the growths are too far apart, or the interval between the appearance of the growths is too long. It would seem that the time interval

between the appearance of the growths in this patient and the absence of metastases would lead one to consider these tumors as independent new growths.

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DISCUSSION.—DR. DAMON B. PFEIFFER (Philadelphia) stated that this case of successive, independent carcinomata was unique as far as his personal experience went. The nearest approach that he had had concerned a woman of 35, operated upon in 1916 for a carcinoma of the right breast. A radical operation was done and metastases found in the axillary nodes. She remained well except for a swollen arm until 1920 when a small lump appeared in the left breast. This was removed and found to be a benign adenofibroma. In 1929, another adenofibroma was removed from the same breast. In 1931, another lump appeared which proved to be a carcinoma and a radical operation was performed. As 15 years had elapsed and there was no evidence of carcinoma elsewhere, and as all appearances pointed toward the second carcinoma being an independent growth and not a metastasis, Doctor Pfeiffer believed that it was truly independent. The following year she noticed a small lump in the left lobe of the thyroid. She was rather toxic and nervous, though her basal metabolism was normal. In view of her history, operation was recommended and the greater part of the lobe containing the nodule, which was about the size of a small acorn, was removed. It was imbedded in the lower pole and microscopic examination showed it to be a carcinoma which at some points was invading the blood vessels. Under treatment with roentgen ray the patient has remained well. Her sister, much older, had a carcinoma of the breast removed 35 years ago and has remained well.

Doctor Pfeiffer went on to say that he had had several cases of simultaneous carcinomata. One was a woman upon whom he operated in 1932 for recurrent appendicitis. Incidentally at exploration a papillary cyst carcinoma of the right ovary, about three inches in diameter, was found. It had perforated the wall and involved the cellular tissues of the pelvis. Feeling certain that recurrence would take place and with the view of giving her the most effective radiation, he placed a capsule of radium in her uterus. She remained well for two years and then began to bleed from the uterus. Curettement showed adenocarcinoma of the fundus. Hysterectomy was car-

## MULTIPLE CARCINOMATA OF THE COLON

ried out. It was interesting that at operation there was no trace of the original carcinoma of the ovary. The peritoneum was clear and the tissues of the pelvis were entirely uninvolved.

Last year he saw a case of carcinoma of the rectum evidently primary which followed carcinoma of the uterus in 1927, and had at present in Lankenau Hospital a man operated upon in January for palpable carcinoma of the descending colon who showed on exploration an additional carcinoma of the rectosigmoid. There was at least one foot of bowel intervening between the two growths and no demonstrable metastases from either. The carcinoma of the descending colon was removed at the first sitting, the distal loop was closed, and at the second stage the remaining growth was removed by an abdominoperineal operation. The laboratory reported no glandular metastases. Two other cases of simultaneous carcinoma of the rectum and sigmoid, apparently independent had also been seen. Neither showed polyposis, although there were a few discrete polyps in one of them.

Such cases, in the absence of knowledge as to the etiology of the malignancy, cause one to speculate as to the possibility of either individual predisposition to malignant disease or the presence of some causative factor, or both. Such common diseases as carcinoma necessarily present many coincidences. Dr. William H. Welch, in combating the idea that cancer was an infective disease, pointed out that the argument based on so called cancer houses, domiciles in which many cases of cancer had occurred, could be accounted for on the basis of the extraordinary prevalence of cancer. Could such cases of multiple carcinomata as Doctor Klingenstein has reported be simply the result of the mathematical probabilities? Warren and Gates in the American Journal of Cancer, 1932, on the basis of 1,259 collected cases of multiple malignancy came to the conclusion that such conditions occur more frequently than can be explained on the basis of chance. There is a growing conviction that there is some factor in the individual that makes him more susceptible to the development of malignant disease and this derives support from the fact that in the experimental production of cancer by carcinogenic agents, it is only in a certain proportion of animals that malignant disease can be produced.

It is interesting that certain tissues are predisposed to multiple malignancy. Skin leads in this respect, and the colon is second. Cokkinis in the British Journal of Surgery 1934 reported a case which showed four simultaneous carcinomata of the descending colon, appearances indicating that all were independent. Bargen and Rankin reported a case of three successive carcinomata of the colon followed by sarcoma of the uterus. Doctor Pfeiffer considered it remarkable that the stomach, the most frequent seat of cancer in the body, has never been reported, to his knowledge, as a seat of successive or simultaneous cancers. General polyposis of the colon is hereditary and practically always ends in cancer of that organ. A collection of cases of this sort might be important in enlarging our knowledge of the nature of cancer.

## THE ANORECTAL PHASE OF LYMPHOGRANULOMA INGUINALE

A. W. MARTIN MARINO, M.D.

BROOKLYN, N. Y.

FROM THE SURGICAL SERVICE, DIVISION OF PROCTOLOGY, BROOKLYN HOSPITAL

THE object of this contribution is to stress the incidence in this part of the country of lymphogranuloma inguinale. This disease has long been considered peculiar to the tropics, where it has been thoroughly observed and fully described as climatic bubo.<sup>1</sup> Frei<sup>2</sup> reported an intradermal test for lymphogranuloma inguinale in 1925, and since then many reports of this condition have come from Europe, South America, and the United States.

In 1932, DeWolf and Van Cleve<sup>1</sup> made the first complete report in this country, and chose the designation "Lymphogranuloma Inguinale." A month later Sulzberger and Wise<sup>3</sup> described this syndrome under the title "Lymphopathia Venereum." The following year Cole<sup>4</sup> wrote an article on the relation of this disease to rectal stricture. He called it the "Fourth Venereal Disease."

Lymphogranuloma inguinale is a specific venereal disease caused by a filtrable virus. The initial lesion is small and evanescent, and occurs on the penis in males, and within the vagina in females. Ten days to three weeks following exposure, the draining lymph nodes enlarge. In the male, because of the location of the primary lesion, the superficial inguinal nodes become involved and eventually suppurate; secondary pelvic involvement may occur. In the female, however, the location of the primary lesion causes the deep pelvic nodes as well as the nodes surrounding the rectum to become involved; inguinal localization is rare. The perirectal involvement produces obliterating inflammatory rectal strictures, usually accompanied by peri-anal elephantiasis and often complicated with multiple fistulae. The most serious sequela of this disease is rectal stricture.

The anorectal phase of this disease has been confused with syphilis, tuberculosis, gonorrhea, and malignancy, but the diagnosis has been greatly simplified by the Frei test which consists of the intradermal injection of 0.1 cc. of antigen prepared from an uncomplicated node in a known case of lymphogranuloma inguinale. The duration of the disease in our cases averaged about 18 years, causing us to agree with others<sup>1, 4</sup> that the skin reaction probably lasts indefinitely.

The remedies suggested for the treatment of this condition are many but reports of their efficacy vary. No specific has been reported. It is generally agreed that the sequelae of lymphogranuloma inguinale, such as rectal stricture and peri-anal elephantiasis, cannot be expected to respond to any other treatment but surgery.

## CASE REPORTS

CASE I.—Mrs. C. S., aged 49, white, a housewife, was admitted to the Brooklyn Hospital, May 24, 1934, complaining of general malaise, difficult defecation, and fever.

For about 20 years she had had difficulty with bowel movements, obtaining evacua-

## LYMPHOGRANULOMA INGUINALE

tions only with enemata and saline cathartics. Fifteen years ago a rectal dilatation was done under a general anesthetic. This gave her temporary relief.

For two weeks preceding her admission to the hospital, there had been increased constipation accompanied by general malaise and afternoon fever. She experienced increasing difficulty in introducing the rectal tube. There had been occasional spotting of blood, but no diarrhea and no urinary disturbances.

*Examination.*—The patient was emaciated, moderately dehydrated, her mucous membranes were anemic, and her tongue dry and furred. Blood pressure 110/80. Urine, normal. Blood Wassermann, negative. The blood count showed a marked secondary anemia.

On abdominal examination the sigmoid was easily palpable and distinctly distended. There was no tenderness. Anorectal examination revealed a fistula in the left posterior peri-anal region. On digital examination an obstruction was encountered  $3\frac{1}{2}$  cm. from the anal opening. On proctoscopic examination the obstruction was found to be a rectal stricture 5 Mm. in diameter.

Frei tests done on admission and five days later were both positive.

*Operation.*—Under spinal anesthesia, 50 mg. of procaine hydrochloride being used, excision of the fistula, and posterior proctotomy were performed May 25. Biopsy was taken. A blood transfusion was done.

*Pathologic Report.*—Sections show no rectal wall identifiable as such. There is a chronic inflammatory process involving fibromuscular tissue with formations of foreign body type nodules in the fat. The inflammatory process does not appear to have any distinctive features.

*Postoperative Course.*—The postoperative course was uneventful. The wound was irrigated with acriflavine 1 to 1,000 and dressed daily. The bowels moved on the third postoperative day and regularly thereafter. The patient was discharged from the hospital ten days after operation with the wound in good condition. She was perfectly comfortable and able to attend to her duties until February 16, 1935 (nine months after discharge from the hospital) at which time she reentered the hospital complaining of copious rectal bleeding of sudden onset of 16 hours' duration.

Proctoscopy showed that the previously described rectal involvement was in better condition than at the time of discharge from the hospital, *i.e.*, the lumen was large enough to permit easy evacuations and there was no evidence of infection. Above this area, however, there was new involvement which extended into the sigmoid which bled easily. The sigmoid and rectum were packed with iodoform gauze which was removed in 24 hours. There was no further bleeding.

The blood showed a moderate secondary anemia for which she was given a transfusion of 500 cc. of blood.

In view of the nature of the disease, the new involvement, and the probability of recurrent hemorrhages, it was thought advisable to perform a colostomy.

*Operation.*—February 18, under spinal anesthesia, using 100 mg. of procaine hydrochloride, a permanent colostomy was performed.

*Postoperative Course.*—The colostomy was not opened until February 28, at which time the abdominal wound was perfectly healed. She was discharged March 16, and has done well thus far.

**CASE II.**—Mrs. A. G., aged 43, white, a housewife, was admitted to the Brooklyn Hospital, August 11, 1934, complaining of pain in the left lower quadrant of the abdomen, constipation, nausea and vomiting, and blood in stool.

She stated that for 18 or 20 years she had been markedly constipated, and for the last two years there were periods when she would not have an evacuation for 12 to 15 days at a time. Toward the end of these attacks she would have marked sense of fulness in the epigastrium. With an eventual evacuation she would be quite comfort-



able again. The last bowel movement had occurred ten days before admission. Occasionally she had noticed blood in the stool. Urine, normal. Wassermann, negative.

*Examination.*—She was poorly nourished, of anemic appearance, and complaining of abdominal pain. The general physical condition was essentially negative excepting for the abdominal and anorectal findings.

The abdomen was distended, especially below the umbilicus. There was tympany throughout. No fluid wave nor shifting dullness were found. There was moderate tenderness in the left flank with abdominal spasm and sense of mass.

Anorectal examination revealed a marked peri-anal elephantiasis. About two inches from the anal opening there was a constriction too small to admit the finger. Proctoscopy showed a cylindrical stricture of the terminal rectum. A piece of this removed for section showed partially necrotic, infected granulation tissue with no special features.

A roentgenogram following a barium enema shows a low intestinal obstruction, demonstrated by a thready filling of the rectum and sigmoid, without ability to expel the enema. This could be produced by an extrinsic lesion. It is, however, suggested that this is probably due to infiltration in the wall of the gut. There is grave danger of the retained barium obstructing the canalized lumen and of producing an intestinal obstruction.

A Frei test was not done at this time due to difficulty in obtaining the antigen.

*Preoperative Diagnosis.*—Cylindrical rectal stricture and peri-anal elephantiasis caused by lymphogranuloma inguinale.

*Operation.*—August 21, under spinal anesthesia, 150 mg. of procaine hydrochloride being used, a loop colostomy of the transverse colon was done. We were unable to use a more distal portion of the colon because the entire rectum, sigmoid and descending colon were stenosed, with infiltration of all the coats.

*Postoperative Course.*—The colostomy was opened the day following operation, and began to function well on the third postoperative day. She was discharged on the twenty-fourth postoperative day with instructions to return to the hospital for attention to the peri-anal elephantiasis. In the meantime she was observed in the dispensary. A Frei test done September 25 was positive.

She was readmitted September 30, her general condition much improved and the colostomy functioning well. The peri-anal elephantiasis, however, was causing her considerable discomfort.

*Operation.*—The enormous peri-anal skin protuberances were removed with scissors on October 1, under spinal anesthesia. Section of the excised tissue showed a granulomatous process in thickened skin. Numerous foreign body giant cells were present.

*Postoperative Course.*—Her recovery was uneventful, and she was discharged on the sixth postoperative day. She is quite comfortable and does not complain of her colostomy.

CASE III.—Mrs. A. W., aged 46, Negress, a housewife, was admitted to the Brooklyn Hospital, September 12, 1933, complaining of anorectal discharge, lumps in the peri-anal region, and constipation of 15 months' duration.

She had had a fistulectomy 21 years ago; operation for rectal stricture 18 years ago; was reoperated on for rectal stricture 16 years ago; and for 12 years before admission had been receiving rectal dilatations regularly. She stated that for 15 months before admission she had developed peri-anal sinuses and swellings which not only failed to heal but increased in number and size. Her constipation had been constant, requiring cathartics and enemata.

*Examination.*—The patient was well developed and fairly well nourished. The heart and lungs were normal. Blood pressure 115/70. There was nothing of note found on abdominal examination excepting a suprapubic midline incisional scar.

## LYMPHOGRANULOMA INGUINALE

Anorectal examination showed an extensive peri-anal elephantiasis with numerous sinuses discharging thin milky pus having a very foul odor. There were several large condylomatous bodies in each anal quadrant. About 5 cm. up from the anus, the rectum presented a dome-like stricture without a palpable orifice. On proctoscopy with an infant proctoscope, a cylindrical stricture which bled easily was found. The bowel beyond the stricture was normal in appearance.

The urine and blood chemistry were normal. The blood count showed a marked secondary anemia. The Wassermann was negative. A radiogram of the chest was negative, and one following a barium enema showed pathology of the rectum and distal portion of the sigmoid with a markedly redundant, mobile sigmoid. Frei tests with controls were positive.

*Operation.*—September 18, under spinal anesthesia, 150 mg. of procaine hydrochloride being used, a colostomy of the sigmoid flexure was performed.

*Postoperative Course.*—She had a stormy time for the first 48 hours, the temperature rising to 104.5° F. During this time, however, the abdomen was soft and there was no distention present. On the third postoperative day, the colostomy was opened, but it did not begin to function well until September 25, after which time recovery was uneventful. On the nineteenth postoperative day it was decided to dilate the rectal stricture and excise the esthiomene.

*Operation.*—October 7, under spinal anesthesia, 50 mg. of procaine hydrochloride being used, a plastic operation was done on the peri-anal elephantiasis, all indurated tissues and sinuses and fistulae being excised. It was thought inadvisable to do more than dilate the stricture with the finger at this time. The excised tissue showed a chronically infected tract in fat with foreign body giant cell reaction.

*Postoperative Course.*—Recovery was uneventful, and the patient was discharged 13 days following the last surgical procedure. She has had periodic dilatations, with the thought in mind that perhaps the colostomy could be closed after sufficient dilatation had been obtained, but the result thus far has been discouraging. She has gained considerable weight, is free from discomfort, and is quite active.

### COMMENT

(1) After a fairly extensive search of the literature, no report has been found with colonic involvement as extensive as in Case II.

(2) The chronicity of this disease is well demonstrated by these cases.

(3) They illustrate three forms that the anorectal phase may assume, *i.e.*, (a) rectal stricture with peri-anal fistula, (b) rectal stricture with peri-anal elephantiasis, and (c) rectal stricture with elephantiasis and complicated with peri-anal fistulae. S  n  que<sup>5</sup> also mentions uncomplicated rectal stricture, and rectal stricture with general pelvic cellulitis.

(4) Although Negro women are supposed to be peculiarly susceptible to this disease, two of these cases occurred in white women.

(5) These three patients each received several courses of tartar emetic intravenously. No recognizable benefit has been noted attributable to its use.

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## INFILTRATING CARCINOMA OF BLADDER\*

## TOTAL CYSTECTOMY WITH BILATERAL NEPHROSTOMY

ABRAHAM HYMAN, M.D.

NEW YORK

CASE REPORT.—M. A., male, aged 45 years, was admitted to Mount Sinai Hospital August 2, 1934, discharged November 4, 1934, with the following past history and present illness:

Typhoid at the age of 12 and a painless hematuria ten years before admission which disappeared spontaneously. Two months ago he noticed blood in his urine at the end of micturition associated with dysuria. Hematuria and dysuria increased, then clots appeared in the urine. There was marked nocturia. Pain in the right groin became progressively worse. Occasional right lumbar pain was felt for five or six weeks before admission and in the last four weeks of this period he lost 22 lbs.

*Physical Examination.*—Marked pallor and emaciation. The right kidney was tender and the lower pole palpable. Rectal examination revealed a large mass above a slightly enlarged prostate. On the left side, there was distinct infiltration above the prostate. The urine was bloody (grossly). Roentgenographic examination of the genito-urinary tract was negative for calculus. The patient's condition was very poor and he was rapidly losing ground. His hemoglobin was 55 per cent and his temperature varied from 99° to 102°. He was given a citrate transfusion of 500 cc. of blood.

*Cystoscopy.*—August 6, 1934, under caudal anesthesia revealed an extensive neoplasm involving a large part of the bladder. The full extent could not be determined but it appeared to extend all around the sphincter margin occupying the posterior and lateral walls and covering the entire trigonal region. The tumor was in part covered by mucopurulent exudate. A number of sections were removed for biopsy studies. The ureteral orifices could not be seen.

*Pathology.*—Infiltrating squamous cell carcinoma.

*Cystogram* showed an enlarged bladder distinctly irregular in contour, with a large filling defect occupying the greater part of it.

*Intravenous Urography.*—August 10, 1934, showed extremely poor function from the right kidney. The dye appeared first in the 45 minute film. The calyces appeared dilated but there was good excretion from the left kidney. The pelvis and calyces were well outlined. The bladder showed a large filling defect occupying its major part.

In view of the persistent right lumbar tenderness and temperature, evidences of definite infection of the right kidney, he was operated upon August 14, 1934, under gas-oxygen anesthesia, a right nephrostomy with drainage being done. The kidney was found enlarged. The pelvis was aspirated and purulent urine obtained. Puncture opening was dilated and a Malecot catheter was inserted in the pelvis. Iodoform gauze drain was inserted and the abdominal wall sutured in layers. Following the operation, the temperature soon dropped to normal and the patient's general condition improved to such an extent that a week later cystectomy was decided upon.

*Operation.*—August 21, 1934, under spinal anesthesia supplemented by gas-oxygen. Total cystectomy and implantation of the left ureter into the iliac region. A median suprapubic incision exposed a huge, solid bladder which was mobilized with difficulty.

\* Presented before the Joint Meeting of the New York Surgical Society and the Philadelphia Academy of Surgery, February 13, 1935.

## CARCINOMA OF BLADDER

The neoplasm (Fig. 1) was found to occupy almost the entire organ. The opening in the bladder was closed with two layers of suture. The left ureter was exposed and found to be moderately dilated. It was divided close to the bladder which was then pedicled on the prostate, which was cut across with the endotherm knife. The ureter was implanted in a small gridiron incision internal to the left anterior spine. The abdomen was closed in layers, with rubber dam and gauze drains down to the pelvis. The patient reacted fairly well from the operation and was given a transfusion of 500 cc. of citrated blood.

August 31, 1934, the left ureterostomy, which had been functioning well, stopped



FIG. 1.—Showing practically complete replacement of cavity of bladder by tumor tissue.

draining. It was found that the ureter had sloughed away and the proximal end had retracted upwards. An attempt to insert catheters or tubes was unsuccessful. The patient was running a temperature of 102° to 103°. Left lumbar tenderness developed and it was decided to do a left nephrostomy.

*Operation.*—September 1, 1934, under gas-oxygen anesthesia. A left lumbar incision exposed a moderately enlarged kidney. The kidney was aspirated and cloudy urine obtained. The puncture hole was dilated and a Malecot catheter introduced. The abdominal wall was sutured in layers with drainage.

The patient's convalescence was protracted and stormy. Attacks of pyelonephritis developed. A large bed sore over the sacrum gave considerable trouble. However, he gradually improved and on November 4, 1934, three months after admission, he was discharged. He has gained considerable weight and both of his kidneys are secreting

well. The left kidney has a phthalein output of 60 per cent in two hours and the right 45 per cent. The bed sores have practically healed and in the three months since discharge he has gained 40 lbs., is able to attend to his affairs and suffers comparatively little inconvenience. He is at present receiving deep roentgen ray therapy.

Total cystectomy, although a very radical procedure, is indicated in this type of lesion for it is the only operation that will give the patient a chance for a cure. Although the published records show a high mortality, varying between 30 and 50 per cent, with careful pre- and postoperative care these figures should be appreciably lowered. In a series of 18 total cystectomies on the service of Doctor Beer, there was a mortality of 22 per cent. In carcinoma of the bladder it is preferable to transplant the ureters into the skin rather than to do a sigmoidal transplantation. Of 13 patients who survived operation, four are alive and well five years after operation (two for six, one for seven, and one for nine years). Of the remaining nine patients, eight have been operated on too recently to report upon and the other two are apparently cured two and one-half years in one case, and in another, one and one-half years after operation.

DR. LLOYD B. GREENE (Philadelphia) remarked that squamous cell carcinoma is one of the rarest and most malignant of the tumors occurring in the urinary bladder. Metastasis is slow and death generally results from the sequelae of lower ureteral obstruction. Coffee reported his experience in 11 cases some years ago. He carried out uretero-intestinal anastomosis with a primary mortality of 27 per cent. It was Doctor Greene's impression that Mr. Henry Wade has always favored bringing the ureters out on the anterior abdominal wall, a procedure easy to accomplish and possible at the time of cystectomy. In a recent article, Mr. Wade has advocated nephrostomy because of the almost impossible task of keeping these patients dry with ureterocutaneous fistulae. Nephrostomy may be practiced on both kidneys at one sitting and does not preclude uretero-intestinal anastomosis at a later date. In doing the nephrostomy, one should be certain to place the tube in the lowermost calix and endeavor to bring it out in such manner as to establish as straight a sinus tract as possible. The replacement of the tube is thereby made a simple matter and may be done by the patient or by some member of his family. There is practically no leakage and life may be very comfortable in spite of the complicated appearance of the apparatus. Marion, Boyd and others have reported patients alive and enjoying life 11 years after nephrostomy. Dr. B. A. Thomas had a patient in whom he had done a double nephrostomy who lived for 20 years.

## MANAGEMENT OF VESICAL CALCULI

### VISUALIZED LITHOLAPAXY

ABRAHAM RAVICH, A.M., M.D.

BROOKLYN, N. Y.

OWING to the appreciation on the part of urologists that urinary stasis is the one constant predisposing factor in calculus formation, stones in the bladder can no longer be considered a distinct entity but must be classified as secondary to some preëxisting obstructive factor. In males the prostate



is usually at fault. Frequent instances of repeated recurrence of vesical calculus have been noted in which a dietary regimen has been ineffective until the removal of the obstructing prostate, following which there were no more recurrences. Since the female bladder neck has no organ encircling and obstructing it like the prostate and in spite of the more sedentary life of women and the similarity of diet in both sexes, primary stones in these bladders are extremely uncommon. Very rarely a calculus having been passed down from the kidney or ureter remains and grows in the bladder on account of stricture or other obstruction in the urethra or vesical neck. Most of the stones found in the female bladder, however, are secondary deposits around foreign bodies introduced into it such as catheters, hair pins, safety pins, chewing gum, candles, tooth picks or sutures which have inadvertently been passed through the bladder mucosa during herniotomies or pelvic operations.

Civiale was apparently the first to suggest the employment of lithotripsy in this condition. Following his crude efforts and armamentarium, many others introduced modifications and improvements of his instrument but it was not until Bigelow of Boston finally standardized both the instrument and the procedure that litholapaxy or lithotripsy has become a popular and generally accepted method. Some urologists, however, still crush stones according to this 50 year old technic.

Prostatectomy at that time being practically unknown and the rôle played by prostatic hypertrophy in calculus formation apparently not appreciated, bladder stone was considered and treated as a disease entity. During that period, therefore, litholapaxy became a very popular and an extensively used procedure, being practiced by most of the surgeons of the time. The frequent recurrence following lithotripsy was attributed to faulty diet or metabolism, or to the technic rather than to the failure of removing the primary cause.

With the advent and development of suprapubic prostatectomy, lithotripsy waned rapidly to such a degree that it had practically become a lost art with many urologists of the younger school. Such an evolution was more or less justified since the stone could be so readily removed through the same incision during the suprapubic prostatectomy. The presence of a calculus in such cases was therefore only of passing interest and did not complicate the situation to any appreciable degree. Furthermore, following the removal of the obstructive pathology by prostatectomy, recurrence of the stone became more or less a remote possibility. Owing to this prevailing tendency towards operative intervention, many found themselves unable through lack of experience to cope with the rare stone that was still best treated by lithotripsy. Due to this inexperience even in such rare instances the operation was naturally considered the safer procedure for the patient and certainly much easier for the surgeon than the difficult blind technic of lithotripsy.

At present with transurethral removal of the prostate, the problem presented by the commonly associated bladder stones has again become impor-

tant. Even though vesical calculus is not a disease entity it must first be treated by lithotripsy before vesical neck resection should be resorted to. Owing to the many defects inherent in the few frail cystoscopic lithotrites that had been introduced during the past 20 years, it is quite logical to expect continued dependence upon the more unwieldy sightless but safer lithotrites of the Bigelow type. Such a procedure entails the following steps: (1) cystoscopy for the diagnosis and localization of the stone, (2) introduction of the lithotrite with blind groping and crushing of the stone and each individual fragment, (3) introduction of the evacuator for the evacuation of the fragments, (4) reintroduction of the cystoscope to determine the presence of any fragments which may have been left over in the bladder, and (5) reinserting in the above sequence of all the previous steps for any of the fragments which frequently remain even after the most diligent search with the lithotrite. Aside from the time factor involved, and the great strain on both the operator and the patient, there is grave danger from the repeated trauma caused by the various instruments introduced into the urethra.

In 1928, a lithotriptoscope (Fig. 1) was presented which represented the basic principles of the original Bigelow lithotrite with all the strength of the original instrument. In it a telescope had been incorporated for grasping and crushing the stone under constant vision with evacuation of the fragments through the same instrument at the one sitting. The pistol handles which replace the old screw and pinion greatly facilitate and shorten the procedure. With a little experience lithotriptoscopy can be done with fewer restrictions and with less effort than litholapaxy. Whereas formerly lithotripsy was contra-indicated for stones in the prostatic urethra or prostatic bed following incomplete prostatectomy, in so called hour-glass bladders, in contracted bladders, for multiple stones, and calculi associated with tumors of the bladder, none of these complicating conditions is now contra-indicated when done under direct vision. The only drawbacks to lithotriptoscopy that remain are a coexisting diverticulum of the bladder which must of necessity be dealt operatively, or the presence of a very large prostate which should be removed suprapubically.

Recurring stones which occasionally form in the prostatic bed after incomplete enucleation of the prostate can very readily be grasped, lifted out into the bladder and crushed without danger to the existing lip. Most calculi impacted in the posterior urethra can also be pushed back into the bladder and crushed. In the presence of vesical tumors no one would attempt a blind type of litholapaxy for fear of grasping the tumor with the jaws of the lithotrite, causing uncontrollable bleeding, whereas with reasonable care lithotriptoscopy can easily be done without danger. Multiple calculi can be handled as easily and rapidly as a single larger calculus.

*Technic.*—Due to very slight variations in the construction of the various lithotriptoscopes and telescopes manufactured since the first instrument was presented, minor difficulties had been encountered by a number of urologists, who wrongfully condemned the instrument because of their failure to prop-

FIG. 1.—Lithorripiroscope without obturator.



erly familiarize themselves with the minor adjustments necessary for the satisfactory performance of the procedure. With a little thought and care these adjustments are easily made and the technic mastered without difficulty.

Attempts have been made to grasp the calculus by bearing down on the floor of the bladder with the jaws of the lithotriptoscope pointing upwards as in the blind method. Such a maneuver, however, is unnecessary and awkward. Observing reasonable care there is no danger of grasping the mucosa of the bladder between the jaws directed downward since the male blade is shorter than the female. With a little practice the handle may be depressed slightly, thereby elevating the jaws away from the vesical floor before one proceeds to crush the stone.

In the original description of the technic the importance of constantly keeping both jaws in the field of vision was emphasized. The telescope being built on the left side of the lithotrite with the jaws and handle pointing downwards, the objective lens and the button on the ocular end indicating its direction should be anchored at about 5:30 o'clock. Being foreoblique in type if the telescope is pushed too far forward the female blade is clearly visible but the male blade is lost sight of when the jaws are opened. Such a maladjustment prevents proper manipulation of the lithotrite. One should familiarize himself with the proper relative position of the telescope before introduction and when the instrument is ready for use the telescope should be adjusted in the desired position by the set screw which locks it in place. A small metal collar into which the telescope fits more accurately has been added which is so fitted as to keep the jaws constantly in the field of vision without further adjustment.

In the presence of a cloudy medium much time can be saved by rapidly flushing the bladder through the irrigating channel with the telescope removed. The same holds true when the fragments and pulverized débris are being evacuated. The evacuator, either a Chismore or Young type, can be applied directly to the large outflow pet cock. During the evacuation of the fragments, the instrument with the jaws directed upwards should be depressed downwards onto the vesical floor and moved from side to side to empty the bladder of all the fragments. Since much of the débris will be lost in the form of powder during the irrigation, one must not expect as much sediment as with the older procedure of litholapaxy. The withdrawal of the lithotriptoscope and the introduction of a metal catheter for complete evacuation of the fragments as practiced by a few is unnecessary since the fragments are very small and can readily be evacuated through the large channel of the instrument. Unnecessary trauma to the urethra by change of instruments should be avoided as much as possible. To avoid clogging of the jaws with the cement-like débris of some stones the handles should be flicked back and forth rapidly from time to time. This dislodges the débris and prevents locking of the jaws and injury to the urethra during the withdrawal of the instrument. Trendelenburg posture is advisable to keep the

## CARCINOMA OF THE JEJUNUM

stone and fragments as far away from the overhanging vesical neck as possible. A light low spinal or sacral anesthesia is recommended.

During the six years that this lithotriptoscope has been employed only one stone was found that was too hard to crush. This was quite large and being perfectly round and smooth it was impossible to dig the jaws into it and nibble it to pieces. It was removed by suprapubic cystotomy. No instance has occurred of breaking of the jaws in the bladder as one cannot grasp on the pistol handles powerfully enough to transmit that degree of tension necessary to cause this to happen. Very large, perfectly round calculi unless of an irregular contour are naturally not amenable to this type of procedure although stones the size of a small hen's egg can with patience be jockeyed into the jaws and may be gradually morcellated. Hematuria during this operation is rather rare. The insertion of an indwelling urethral catheter for several days is advisable to avoid urinary retention from possible edema of the bladder neck.

### CONCLUSIONS

With the present day necessity for conservatism in prostatic surgery, as expressed by transurethral resection, proper management of the frequently associated vesical calculi assumes an important rôle. With the use of the present instrument the scope and indications for litholapaxy had been increased and simplified to a considerable degree. Although the technic had been outlined in several previous papers,<sup>1, 2, 3, 4</sup> owing to slight variations in the lithotriptoscopes and telescopes certain defects have been corrected. Explanation has been offered of several of the more common difficulties encountered. With the proper performance of lithotripsy many unnecessary cystotomies with the accompanying mortality, morbidity, prolonged hospitalization and convalescence can be avoided.

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## CARCINOMA OF THE JEJUNUM \*

### REPORT OF THREE CASES

HENRY W. CAVE, M.D.

NEW YORK

SINCE the opening of The Roosevelt Hospital, 64 years ago, three specimens of carcinoma of the jejunum, are the only ones entered in the laboratory files. Nothnagel reports nine instances of carcinoma of the jejunum in 3,585 carcinoma deaths, and Johnson in a series of 41,883 autopsies in the Vienna General Hospital did not find a single case of carcinoma of the

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\* Presented before the New York Surgical Society, January 23, 1935.



jejunum, although there were in the same series 343 cases of carcinoma in other parts of the intestine. Up to 1934 there had been less than 200 cases reported in the literature. Those occurring close to Trietz's ligament (Case II) are very rare. The preoperative diagnosis is seldom made, the abdomen usually being opened for suspected gallbladder, or other biliary tract disease, peptic ulcer or chronic appendicitis with the symptoms referred to the epigastrium.

The symptoms and signs in the beginning are vague; as the disease advances, they depend upon the amount of stenosis present. Even in the later stages the symptoms are difficult to classify. The nonstenotic growths give very indefinite symptoms, unless (Case II) they have attached themselves to other abdominal viscera. Colicky pains in the epigastrium associated with nausea and vomiting of a large quantity of fluid containing bile, pancreatic juice and other duodenal content, should cause one to suspect cancer of the jejunum. Some French writers lay great stress on the extremely profuse vomiting of green fluid. A massive hemorrhage seldom occurs, yet by careful examination not infrequently occult blood may be found in the stools. Usually there is a secondary anemia of low grade. The diagnosis is seldom made before operation or postmortem examination.

The roentgen film has been of little aid up to the present time. With the tumor high in the jejunum, even slightly obstructive, the barium meal and fluoroscopy usually show a laking of barium remaining for a short time in the upper part of the small intestine shortly after it has passed through the duodenum. In indeterminate intestinal hemorrhage as in instances of bleeding Meckel's diverticula, the diagnosis of cancer of the jejunum, or, in fact, any part of the small intestine, should be corroborated or eliminated by immediate exploratory celiotomy.

Treatment is naturally a very prompt removal of the growth with excision of an abundant portion of the mesentery with anastomosis either end-to-end or side-to-side. It has been suggested that if the growth is close to Trietz's ligament, a preliminary gastro-enterostomy is advisable; however, it seems to me that if the tumor is not a stenotic one preliminary gastro-enterostomy is hardly necessary. In those having marked obstruction with dilatation of the upper jejunum, duodenum and stomach, Wangensteen's continuous suction is indicated postoperatively for a few days. Naturally in the debilitated patient with loss of weight, transfusion before and after operation will be of benefit.

#### CASE REPORT

CASE I.—H. A., a white American male, aged 50, a baker by occupation, was admitted to The Nassau Hospital on October 9, 1933, with a complaint of pain in the left groin of eight weeks duration, with vomiting for two weeks. I am able to present this specimen due to the courtesy of Dr. Benjamin Seaman of The Nassau Hospital, Mineola, Long Island, N. Y., who operated upon the patient, and also to that of Dr. Sophian, pathologist at The Roosevelt Hospital.

*Present Illness.*—While at work eight weeks before admission, the patient expe-

## CARCINOMA OF THE JEJUNUM

rienced pain in the left loin, which was followed by four succeeding, quite severe, attacks. There was no hematuria or burning. For two weeks vomiting has occurred after eating anything more than a few mouthfuls. The vomitus was bile stained and mucoid in character. There was increasing constipation. The patient lost ten pounds in this eight weeks period.

An important point of the physical examination was that in viewing the abdomen, particularly the epigastrium, peristalsis could be seen running from left to right. The umbilicus showed rhythmic retraction and below the umbilicus there was a wave of visible peristalsis from right to left. As the wave passed, a large loop of distended bowel pressed forward. A barium meal showed a dilated stomach and a duodenum distended with a gas bubble and fluid level.

*Diagnosis.*—Obstruction in the upper jejunum.

*Operation.*—On October 10, 1933, Doctor Seaman, disclosed a hard, annular neoplasm 20 inches from the origin of the jejunum, with marked dilatation above the growth, and collapsed bowel below. A portion of the jejunum 18 inches long was resected. Side-to-side anastomosis was done. Hard lymph nodes were noted in the mesentery and removed. The patient died 18 days later.

*Autopsy* revealed perforation of the suture line of the closed end of the upper loop. Peritonitis.

*Pathologic Diagnosis.*—Adenocarcinoma of the jejunum, Grade II, annular obstructive with metastases to the mesenteric lymph nodes. General peritonitis.

CASE II.—F. E. S., a male, night watchman, 65 years of age (Roosevelt Hospital history No. 341008). Admitted March 10, 1934, with the chief complaint of loss of vitality, abdominal pains and excessive flatulence during the last 18 months.

*Present Illness.*—Eighteen months before admission the patient fell, striking his left anterior chest wall. Prior to that he had felt perfectly well, subsequently his health began to fail. Distress in the epigastrium began at this time. It was indefinite at first, but later rather severe, coming on immediately after the intake of food, no radiation, although on some occasions it did not occur until 30 or 40 minutes later. The only way he could find relief was to lie face downward with his thighs flexed and his fists pressed against his epigastrium. After lying in this position for half an hour or so he was usually relieved of his pain and able to get up and go about his duties.

There was excessive flatulence with eructation of gas; he could hear the "rumbling of gas" in his abdomen. His constipation increased so that large quantities of cathartics were required to effect a movement. For some reason, when constipated, his epigastric pain was less, and recurred with renewed severity after evacuation. He gradually lost 16 pounds in weight and strength and at the time of entering the hospital was living on nothing but soups. For six months his pain had been almost constant across the lower abdomen, more marked in the right lower quadrant, and not related to meals or defecation. On one occasion, nine months before admission, he noticed bright red blood in his movements, but had not seen any tarry or clay colored stools. No nausea or vomiting. For six months there had been some increased frequency but no dysuria or hematuria.

*Physical Examination* showed the abdomen slightly distended. Borborigmi over the entire abdomen. There was a slight involuntary spasm over the right upper quadrant and resistance midway between the umbilicus and the symphysis. Just to the right of the midline there was a non-tender mass, 5 x 7 cm. in diameter, firm in consistency, irregular in outline and slightly movable. The liver and spleen were not felt. Rectal examination revealed a symmetrically enlarged prostate five times normal size.

*Laboratory Findings.*—Urine essentially negative. Hemoglobin, 82 per cent; R.B.C., 5,000,000; W.B.C., 12,000; polymorphonuclears, 78 per cent. Blood chemistry: urea nitrogen 12.3; sugar 138. Blood Wassermann, negative.

*Roentgenographic* studies of gastro-intestinal tract, negative.

*Operation.*—March 16, 1934. End-to-end suture; jejunostomy by Dr. Henry W. Cave.

*Pathologic Report.*—Adenocarcinoma of the jejunum, Grade III, with metastasis to the adjacent lymph nodes.

*Result.*—The patient made a satisfactory recovery. The jejunostomy opening closed on the twenty-third day after operation. Six months later, September, 1934, his family reported his death apparently from pneumonia. This, in my opinion, was terminal pneumonia, the real cause of his death the result of metastases.

CASE III.—J. R., a male, aged 76 years (Roosevelt Hospital No. B). Admitted April 28, 1934, complaining of jaundice, pain in the stomach, indigestion and loss of weight for a period of 14 months. An exploratory celiotomy was done, what was designated as carcinoma of the common bile duct was found and a cholecystoduodenostomy was performed.

*Second Admission.*—November 8, 1934, the patient returned to the hospital, having had pain during the interim, and complaining also of having had sour stomach and eructations for six months, with vomiting after each meal for the past two or three months. The vomitus was very watery and contained practically no solid matter. He had had no tarry stools and no jaundice, but had lost 15 pounds in weight.

*Physical Examination* revealed an extremely emaciated, elderly white man. There were numerous sonorous râles throughout both lungs. The radial arteries were extremely sclerotic. Abdominal examination revealed a large ventral hernia protruding through the old operative scar chiefly in the right upper quadrant.

*Laboratory Findings.*—R.B.C., 2,900,000; Hemoglobin, 50 per cent; Wassermann, negative; examination of feces for blood, negative.

*Radiographic Examination.*—A gastro-intestinal series showed marked dilatation of the stomach, with 90 per cent retention after six hours. There was almost total obstruction of the stomach by a lesion around the pylorus.

*Preoperative Diagnosis.*—A diagnosis of obstruction was made with cause unknown; ventral hernia; general arteriosclerosis; chronic bronchitis; secondary anemia.

*Course.*—The patient was rehabilitated by supportive measures and gained eight pounds in one month. December 7, 1934, under local anesthesia, exploratory celiotomy was done by Doctor Russell. On examining the small intestine a tumor of the jejunum was found just distal to the ligament of Trietz, lying within the lumen of the bowel. The mass was excised and the wound formed by removal of the tumor used to perform a posterior gastro-enterostomy. The following morning he became comatose and partially cyanotic. On the fourth day postoperative he died from what was thought to be cardiac failure.

*Pathologic Report.*—Macroscopic examination showed a cauliflower-like tumor measuring 6 x 5 x 3 cm. It had a short stalk 3 cm. in diameter. Microscopic examination showed regular gland spaces lined with dark hyperchromatic, irregular shaped cells invading the basement membrane. There were some large cystic areas containing mucus and glandlike spaces in the submucosal layer. Mitotic figures were present. Single cells could be seen in the muscular layer.

*Diagnosis.*—Papillary adenocarcinoma, Grade I.

DISCUSSION.—DR. WM. BARCLAY PARSONS, JR., found that in the past 20 years there had been six cases of small intestinal carcinoma, at the Presbyterian Hospital excluding carcinoma of the terminal ileum at or near the ileocecal valve. Of these, three were in the midileum and three in the jejunum proper.

Of the cases in the ileum, one was found by chance. The patient had been on the medical side with lobar pneumonia and pneumococcus endocarditis from which he succumbed. At postmortem examination, a small carcinoma

## CARCINOMA OF THE JEJUNUM

was found in the midileum which had never given any symptoms. The other two cases had some obstruction, one having in addition a very large retro-peritoneal tumor, which was explored and found to be carcinoma. He died shortly after the operation and on postmortem examination the tumor of origin was found to be a carcinoma of the ileum. The third case was resected and was seen recently, 42 months following operation, and was apparently in good health.

Of the cases in the jejunum, one patient entered in very bad condition following prolonged chronic obstruction. He died postoperative and it was found he had a carcinoma of the jejunum. The second patient came in with acute obstruction due to a recurrent carcinoma of the colon at a previously made enterocolostomy; at postmortem a jejunal carcinoma was found arising in a polyp. Again, the jejunal lesion was an accidental finding. The third case had a resection of a carcinoma of the jejunum and two years later a carcinoma of the ovary weighing 15 pounds was removed which was considered at first to be of a different type. Seven months later the patient came in for general care with generalized carcinomatosis. Reexamination of the various specimens led the pathologist to feel that all of the tumors were of the same type, originating in the jejunum. We have had only these three autopsy cases of carcinoma of the jejunum out of 3,744 autopsies since 1917.

DR. C. J. MACGUIRE, JR., showed a case a few years ago of annular carcinoma of the jejunum about 14 inches below the ligament of Treitz. A complete exploratory operation demonstrated no metastases, but on speaking to the pathologist at the time he was told that these jejunal carcinomata were very malignant and that the prognosis was bad, in spite of failure to find metastases at the time of operation. A wide resection with end-to-end anastomosis was done. This patient died within eight months after presentation to this Society, with widespread abdominal carcinomatosis and without autopsy.

DR. EDWARD W. PETERSON had a case of carcinoma of the jejunum some years ago in a colored man, 46 years of age. At operation, an annular, scirrhous growth, 18 inches below the ligament of Treitz, was found. There were extensive metastases present, and no attempt was made to do a radical operation. A lateral anastomosis, side-tracking the growth, was made to relieve the intestinal obstruction. The patient died a few months later.

Recently Dr. R. Franklin Carter operated upon a case of carcinoma of the jejunum, occurring about eight inches from the ligament of Treitz. It was of the annular type. The patient is still living.

DOCTOR CAVE: The literature impresses one with the high degree of malignancy in the reported cases. Another feature is the high operative mortality ranging from 16 up to 32 per cent. In view of this he believed some type of extirpation operation might be advisable in carcinoma of the small bowel, similar to that employed in handling carcinoma of the large intestine; enterostomy above the tumor in many of these cases where there is obstruction is advisable. Most of the fatalities occur as a result of peritonitis at the site of anastomosis. Most writers on the subject have casually considered cancer of the small bowel usually amenable to primary resection, but he believed that where there is an obstruction we have the same condition to consider as in obstruction of the large bowel.

## INJURIES OF THE SHOULDER GIRDLE

WILLIAM LISLE BELL, M.D.

OAKLAND, CALIFORNIA

IN ALL traumatic repair two major themes confront the surgeon: First—The restoration as nearly as possible of the normal anatomic structure and second the avoidance of injurious pressure to vital but innocent structures during this process of restoration. All methods, whether open or closed, metallic or otherwise, fixed or flexible, stationary, portable or ambulatory, must conform partly at least to these two desiderata. Minimizing of pressures and shock must include not only tissues adjacent to the injury but also those at some distance.

The splinting devices for the injuries considered are many. Velpeau and Desault gave us the fundamentals of treatment almost a century before Mathysen made plaster of Paris available as a true splinting product in 1852. The theorems propounded by these two workers have become well known. So far as we may learn Velpeau and Desault had nothing suitable, with which to construct rigid and dependable bases for secondary structures as we employ them today.

## DISPLACEMENTS OF THE ACROMIOCLAVICULAR ARTICULATION

In analyzing three sets of records I find one of 1,900 fractures with two acromioclavicular displacements, another of 3,500 with 11, and a third series of 200 with 20. We are concerned with the treatment and results of the three injuries considered in this article which are so interlocked in their methods of treatment and so similar in basic construction that they may well be grouped together.

It was evident that a central, firm, practically immovable base must be constructed from which appliances could reach out and around the innocent structures and apply directing force where needed, and in such a way that each step could be controlled independently or in any combination with other procedures.

*Method.*—A chest girdle of plaster of Paris eight to ten thicknesses, four to six inches wide, incorporating a bent metal wicket over the injured shoulder is applied snugly to the chest over several wide turns of sheet wadding. Two shoulder straps of firm but light canvas (six ounce) well padded on top of each shoulder which pass beneath the chest girdle and sheet wadding are turned backward front and rear over the lower edge of plaster of Paris girdle and tightened so as to lift this girdle just snugly but not too closely against each axilla. The arm and forearm lightly encased, with the elbow at a right angle, are now elevated by strong cords passing from the wickets emergence from plaster in the rear, down and around the midelbow, up in front and anchored to the wicket where it emerges from the plaster jacket in front of the axilla. This elevating cord or cords should not be forward on the forearm and may be movably retained by a loose bracket of



## SHOULDER GIRDLE INJURIES

small wire passing over it where it crosses the elbow. A handkerchief or other firm bandage may be used in lieu of the cord. This strong elevating cord may be doubled and incorporated in the plaster of Paris around and under the olecranon. The loose ends must be sufficiently long to tie easily and firmly around the wicket at the top edge of plaster of Paris chest girdle.

The plaster of Paris bandage which fixes the arm and forearm at a right angle runs far enough out to support the ulnar side of the hand but is cut away on the radial side as far back as the wrist. This encasement may be very thin (one or two plaster bandages) balanced and thicker of course at the elbow. Light sheet wadding underneath this arm case and much sheet wadding (20 thicknesses) between plaster case and olecranon. If more limitation of motion is desired in the arm and forearm a light circular bandage may surround arm and chest.

The number of these cases that come to us for operation and the vast array of operations suggested for relief bear witness to the inadequacy of the primary correction. It is frequently said that such a shoulder widely separated and torn cannot return to function without radical surgical aid. The injury should be splinted within three or four days, better three or four hours.

The basic technic is identical for acromioclavicular dislocations, tears or for fractured clavicles. The detail of the two procedures differs somewhat. In both conditions we employ the rigid chest girdle, the suspenders, the wicket, the plaster encased arm and the arm lift. In acromioclavicular dislocations the suspender on the injured side may be wide and approach very near the acromion process where it crosses the clavicle. Its lower extremity too may be slightly farther away from the anterior midbody line where it rests in a shallow notch in the lower edge of the plaster girdle. This gives it more nearly a vertical position with the patient standing. With the fractured clavicle this shoulder strap should be narrower and rest with its thick pad over the inner clavicular fragment. The lower extremity of this suspender where it turns around the lower edge of chest girdle should be one to two inches nearer the median line. This inward angulation at the lower end prevents the strap from creeping outward from the base of the neck and losing its downward pull on the inner fragment. The large firm pad which I always use between the wicket and anterior surface of the shoulder for "shoulder back" in fractured clavicles is sometimes dispensed with in acromioclavicular dislocations. The wicket is advisable in both injuries. It stiffens the plaster girdle and forms two rigid bars for attachment of the arm lift cords or bandage. A section of wooden tongue depressor fastened across shoulder straps with half inch adhesive tape on top of each shoulder prevents the shoulder strap from wrinkling or roping. If one is meticulous the chest girdle may be trimmed well below the axillary folds on the injured side, leaving a fully exposed axillary space.

The application of this mechanism is rapid. Its purpose plain. Any amount of downward pressure may be imposed upon the displaced clavicle

up to the point of tolerance. The arm is lifted at the same time which brings the acromion into place. Neither lifting cords nor shoulder straps slip or creep. They are firmly anchored to the rigid dependable chest girdle. The pull of the arm lifting cords around the deeply padded but lightly plaster encased elbow, is downward on the plaster girdle at B. This downward pull lowers the chest girdle PG completely away from the axilla and at the same moment by its cantilever action depresses the clavicle. The more vigorously we lift the arm the more firmly we depress the clavicle—all the while open-

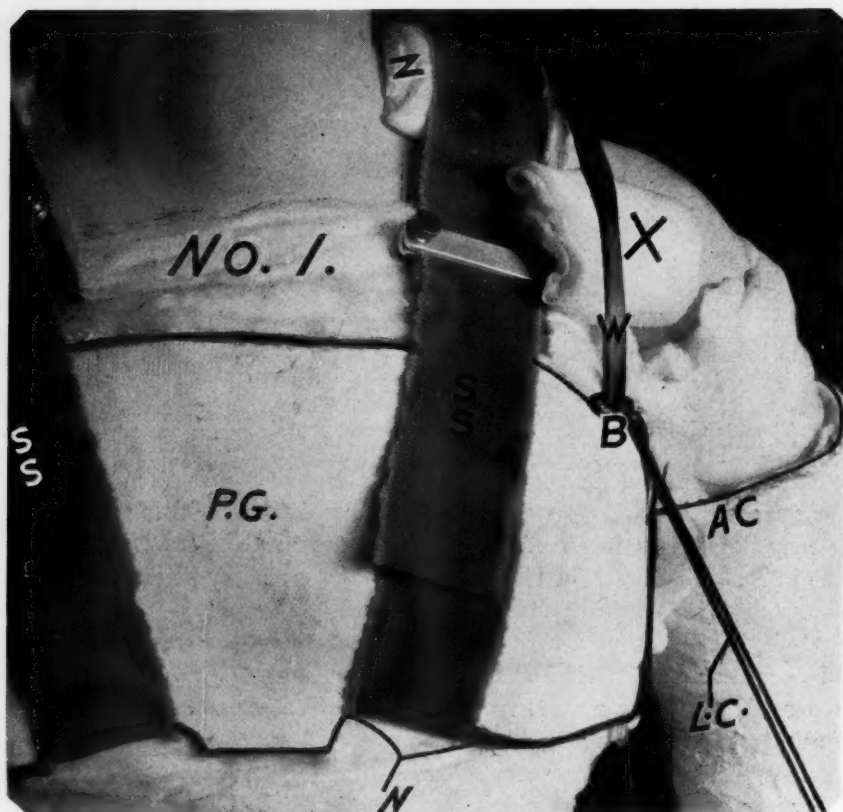


FIG. 1.—Displaced acromioclavicular articulation and fractured clavicle. SS.—Firm shoulder straps. PG.—Plaster chest girdle held firmly by straps SS. Z.—Pads under straps. W.—Wicket front and rear of shoulder. X.—Pad against wicket for shoulder back. LC.—Lifting cord or bandage. N.—Notches in plaster for preventing side slipping of shoulder straps. B.—Wicket buried in plaster to which is tied arm elevating cord LC.

ing a wider space between top edge of chest girdle and axilla. This pressure must be moderate. Too much tension on the arm lifting slings will cause the patient discomfort at Z under the shoulder strap. If the mere weight of the arm and forearm transferred around the axilla to Z is uncomfortable, this weight may be slightly lessened by supporting the forearm from the wrist to the shoulder strap of the uninjured side. This procedure will rarely be found necessary (Fig. 1).

## SHOULDER GIRDLE INJURIES

### FRACTURED CLAVICLES

Figure 1 completely portrays the technic in these injuries. The inner clavicular fragment is held downward, the outer fragment and acromion elevated and the shoulder softly and comfortably but dependably pushed backward by the firmly rolled sheet wadding pad X between wicket and shoulder. Two fractured clavicles in the same patient are just as expeditiously treated. The patient may rest fairly comfortably in bed. No adhesive plaster touches the skin. The chest plaster girdle is wide and firm in every direction and

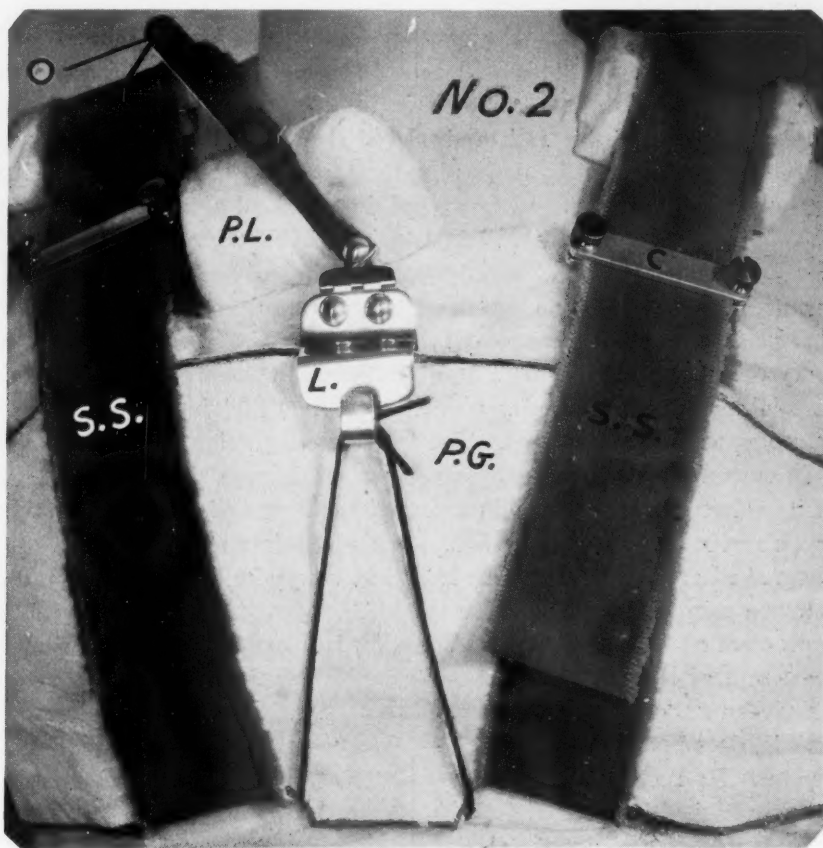


FIG. 2.—Displaced clavicle at sternum. PG.—Rigid fitting plaster of paris chest girdle. SS.—Padded shoulder straps. L.—Lever anchored to PG as rigid fulcrum. PL.—Compression pad under lever and over inner end of clavicle. O.—Hole in rear end of lever for depressing cord to plaster case on back. No wicket on arm lift in this treatment.

does not cut in or pull out of shape as do circular chest straps. The bent shoulder wicket made of one-quarter inch round duralumin rod or steel rests closely against the shoulder in front when the shoulder is well back, but is four inches above on top and four inches to the rear of the posterior aspect of the shoulder. This allows sufficient space for movement of the shoulder well upward and backward. It is astonishing how much elevation and posterior position we sometimes need to obtain even a fair correction.

The narrower shoulder strap with its slightly different angle was discussed under acromioclavicular injuries. Good sized fenestra up to two inches in diameter may be cut (always circular) in the chest girdle at appropriate points.

FORWARD DISPLACEMENT OF THE CLAVICLE AT THE STERNUM  
STERNOCLAVICULAR DISPLACEMENT

Forward or forward and upward displacement seems to be the rule at this articulation. I feel that this condition is frequently overlooked; particularly where the displacement is not great or the patient has other injuries of greater moment.

A flexible lever is constructed, attached to the midline in front, a bandage roll placed over the inner end of displaced clavicle and pressure downward and backward completed by depressing the posterior perforated end of lever by means of a cord from rear lever end down to and around posterior portion of chest girdle (Fig. 2). I like to immobilize this displacement 10 to 12 weeks. And the utmost care should be enjoined to prevent slipping of structures during this time. It is not unusual to find a displacement or tearing of ligaments at this point in fractures of the clavicle. This leaves a very movable inner fragment and one difficult to control. In such cases this additional lever is readily placed in position and helps remarkably in controlling this inner fragment. The space for its placing is wide open.

In fractured ribs when accompanying other injuries the chest girdle also has its value. In both sternoclavicular dislocations and fractured ribs, arm lifts are of course dispensed with. The girdle is wider in most cases of fractured ribs and quite tight. If it loosens it may be sectioned in front and its lumen narrowed with adhesive tape. This gives us a continuous follow up pressure as long as needed. As opposed to many I believe in complete encasement of the chest in fractured ribs. Limitation of pulmonary excursion gives rest to both the lungs and the patient. This jacket is light, comfortable, does not irritate the skin and with the two shoulder straps remains in place. Its removal is simple and does not entail any of the discomfort occasioned by adhesive tape.

In fractured clavicles the period of 10 to 20 days treatment induces no permanent fibrosis at the elbow or shoulder. In displacements of the acromioclavicular articulation which seem to demand not less than eight weeks and often more prolonged fixation, the plaster case may be bisected horizontally from around elbow to hand. This produces a removable under half of the forearm case. When the patient is supine this lower half may be removed, the elbow straightened and gently massaged. This light arm and forearm plaster of Paris case is merely to distribute pressure. A considerable space exists between its top and the chest girdle. They are not fused or connected at any time except movably through the elevating cords or bandage.

## HORNER'S SYNDROME

### HORNER'S SYNDROME \*

#### FOLLOWING CERVICAL SYMPATHETIC NERVE BLOCK TO THE UPPER EXTREMITY

RUSSEL H. PATTERSON, M.D.

NEW YORK

CASE REPORT.—J. P. M., aged 22 years, an American male, was admitted to Cornell Clinic in September, 1931 (History No. 83505) and later, in January, 1932, to Bellevue Hospital.

*Chief Complaint.*—Pain and swelling of various joints of eight months' duration.

*Present Illness.*—Insidious onset eight months ago. Pain and swelling of fingers, wrists and knees, and pain and stiffness in the shoulders.

*Physical Examination.*—Fusiform fingers with slight limitation of motion of the wrists, shoulders and left knee. There is a tendency to cold, clammy hands.

*Diagnosis.*—As a result of serologic tests by Dr. W. Stainsby and physical examination in a diagnosis of rheumatoid arthritis, early and moderately active, was made.

February 11, 1932, the first and second left dorsal sympathetic ganglion areas† were injected with first 3 cc. of 2 per cent procain and 30 minutes later 4 cc. of absolute alcohol in each of the same areas. There was a maximum increase of 12° F. in surface temperature at the finger tips and in the characteristic manner as the elbow and axilla were approached the skin temperature gradually reached normal. A Horner's syndrome appeared on the left side.

February 13, 1932, the first and second left lumbar sympathetic ganglion areas were blocked in a similar manner with procain and alcohol and there was the same relative increase in temperature of the left lower extremity.

February 16, 1932, the right second and third dorsal sympathetic ganglion areas were blocked in a similar manner as those had been on the left side February 11. There was the same proportionate rise in surface temperature and a marked Horner's syndrome appeared. At this time it was noticed that there was a decrease in the temperature elevation of the left upper extremity and also the Horner's syndrome on the left side had practically disappeared.

February 18, 1932, the first and second right lumbar sympathetic ganglion areas were blocked in a similar manner as those on the left, with like results.

In March, 1932, it was noted that the right hand and both feet were warm and dry, the left hand was cold and clammy, evidently the left dorsal injection had not been effectual. Horner's syndrome was very marked on the right, but not present on the left.

January 6, 1933, or about 11 months after the sympathetic alcohol blocks, the patient was again examined. There was definite evidence of a moderate Horner's syndrome still present in the right eye, there being very slight ptosis of the right eyelid, incomplete reaction of the pupil to light, and dryness of the right side of the face. The arthritic symptoms were much less marked. The acute swelling and pain had almost disappeared.

#### COMMENT

(1) Horner's syndrome is relatively infrequent.

(2) The syndrome was produced by the introduction of alcohol about

\* Presented before The New York Surgical Society, February 27, 1935.

† It should be pointed out that after our experience with 25 or more of these injections on human beings we found that a complete blockage of the sympathetics to the upper extremity was always obtained if the solution was injected about the first and second dorsal sympathetic ganglion areas. It is assumed that the solution extends up the sympathetic chain and includes the stellate ganglion and also extends downward to about the fourth dorsal ganglion.



the sympathetic ganglia in the lower part of the neck and the upper dorsal region. The alcohol certainly was not injected directly into the ganglia but probably diffused into the loose areolar tissue around the ganglia and formed dense scar tissue which cut off the nerve impulses. I know of only one case so treated and later autopsied. This was done by Dr. J. C. White of Boston who blocked the upper dorsal ganglia in a case of angina. Several months later, when the patient died, at autopsy only scar tissue could be found at the sites of the previous injections.

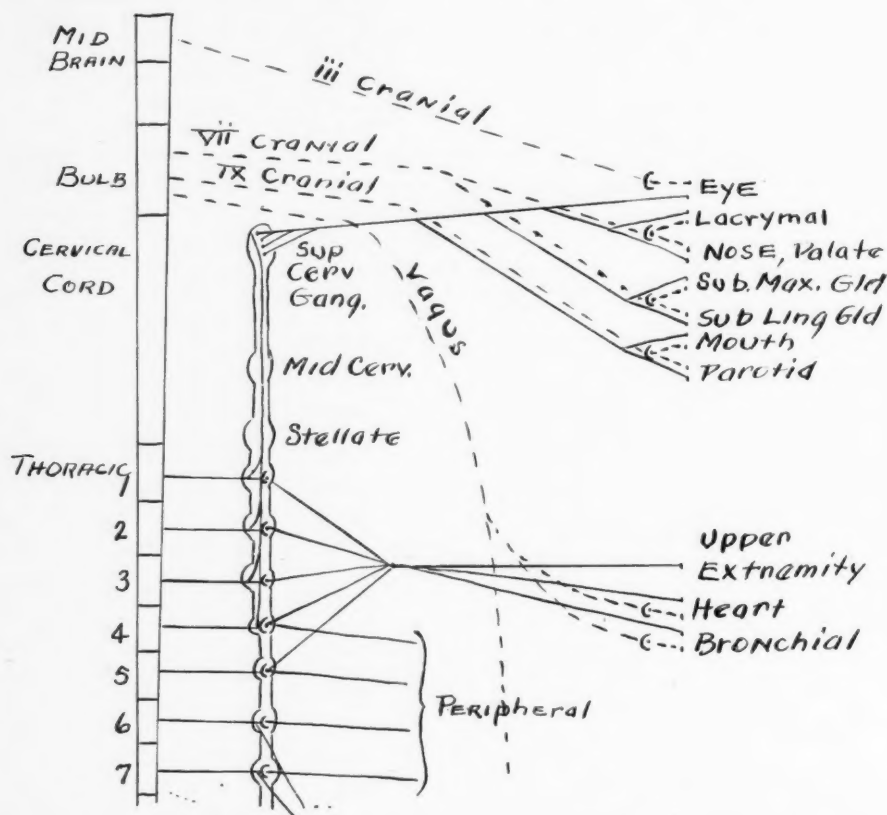


FIG. 1.—Shows diagram of upper thoracic and stellate sympathetic ganglia illustrating the fact that excision or blocking of these ganglia does three things: it interrupts the sympathetics to the upper extremity; it interrupts the entire cervical sympathetic, and it interrupts the afferent fibers from the heart and bronchi.

(3) This case illustrates a very important fact: that with present technic we are unable to interrupt completely the sympathetics to the upper extremity without interrupting the sympathetics to three other important parts of the body, namely, the cervical sympathetics, which supply the eye and when interrupted produce Horner's syndrome, and the afferent sympathetics from cardiac and pulmonary plexuses (Fig. 1). Before interrupting the sympathetics to the upper extremity we must decide whether or not the interruption will result in sufficient benefit to the extremity to outweigh the detri-

mental effects of the associated interruption of the sympathetics to the eye and chest organs.

(4) Another interesting point is whether or not the production of a Horner's syndrome really brings about a real enophthalmus or whether such is merely apparent due to the drooping of the eyelid. This point has not been definitely determined. The application of this idea has been tried many times. According to Parsons, the benefit in two cases of exophthalmic goiter seemed to be due to a paralysis of Müller's muscle, and there was no resultant decrease in the exophthalmus.

(5) Parsons stated further that he would hesitate to use the operation on both sides because of possible interference with night vision. Adson, however, reports that the condition, when bilateral, is rarely complained of unless unequal and also that there is no serious interference with vision in the dark.

(6) White states that when the operation of blocking is not carried above the first dorsal ganglion, only a slight Horner's syndrome appears; but if the inferior cervical ganglion is included a permanent Horner's syndrome follows. We have found this to be true in the cases we have done.

DISCUSSION.—DR. IRA COHEN said that the case presented by Doctor Patterson demonstrated that one cannot interrupt the sympathetic supply to the upper extremity without producing Horner's syndrome. In fact, that is one of the certain means of telling whether the alcohol injection has been properly placed. From the inferior cervical ganglion the sympathetic nerves go to the seventh and eighth cervical and sometimes the sixth and seventh thoracic nerves. From the middle ganglion they go to the fifth and sixth. If this ganglion is absent they often come off the trunk. Therefore, if one properly interrupts the sympathetic supply to the upper extremity one has to interfere with the sympathetic chain and a Horner's syndrome will result. Whether this syndrome is lasting, or not, depends entirely upon the completeness of the interference. It seems to grow less in some cases, even after removal of the upper thoracic and the stellate ganglia. It is rather unusual for an alcohol injection to give a complete Horner's syndrome lasting over a period of several years. Usually there will be found a recession and more or less improvement.

NOTE.—This case is one of a group of cases so treated by Dr. Wendell Stainsby and myself on the Cornell Division at Bellevue Hospital.

## CARCINOMA OF PAPILLA OF VATER \*

### RESECTION OF DUODENUM AND HEAD OF PANCREAS

WILLIAM BARCLAY PARSONS, M.D., AND CLINTON R. MULLINS, M.D.

NEW YORK

CASE REPORT.—E. W., Unit History No. 422738, admitted to Presbyterian Hospital July 16, 1934, complaining of itching and jaundice of two months' duration. He was a boatman, 53 years old. Grandfather died of carcinoma of the stomach. Otherwise the family and personal history were irrelevant. Three months before admission, the patient had some bad colds and his appetite began to fail so that when first seen he weighed

\* Presented before the Joint Meeting of the New York Surgical Society and the Philadelphia Academy of Surgery, February 13, 1935.

only 125 pounds, representing a loss of 20 pounds in this brief period. One month later, itching developed, followed shortly by jaundice. There was nausea but no vomiting and no pain. He was markedly constipated and the stools were clay colored, the urine dark.

Physical examination revealed a poorly nourished, intensely jaundiced man, with numerous small scratch marks over his trunk. The abdomen was slightly distended and what was judged to be a large, distended gallbladder could be felt in the right upper abdomen. The liver was enlarged and palpable two fingers below the costal margin. The laboratory findings were: Wassermann, negative; serum bilirubin, 10.7 mg. per cent; blood amylase, 5.8; R.B.C., 2,700,000; Hb., 77 per cent, and no bile obtainable by duodenal drainage.

The diagnosis was obstructive jaundice, due probably to carcinoma of the pancreas. At operation, July 18, the gallbladder was found to be markedly distended but neither



FIG. 1.—Showing prominent papilla of Vater.

it nor the common duct contained stones. A hard, small mass was felt in the head of the pancreas, near the papilla of Vater, on the deep surface. No metastases were seen in the liver. A cholecystogastrostomy was performed.

The patient recovered satisfactorily from the operation. His serum bilirubin fell, the jaundice cleared, and itching improved. However, considerable anemia was still present at the end of two weeks. Liver extract and repeated small transfusions were commenced.

In view of the fact that dogs tolerate complete severance of the duct connection with the duodenum and that patients with lesions in all probability obstructing the pancreatic flow have survived for considerable periods of time following cholecystogastrostomy, resection of the head of the pancreas was suggested by Doctor Mullins.

After a few days at home, the patient returned for a partial pancreatectomy. He was in fairly good condition, weighing 116 pounds and with a serum bilirubin of 2.5 mg. per cent.

## CARCINOMA OF PAPILLA OF VATER

August 21, under pantocaine anesthesia, the abdomen was reopened through a slanting oblique transverse upper abdominal incision. The stomach and gallbladder were adherent to the under surface of the liver and it was impossible to view the cholecystogastrostomy. The duodenum was liberated from the superior angle down to the line of the superior mesenteric vessels, and turned inward with the head of the pancreas. The lesion was found to consist of a hard mass in the region of the papilla of Vater. The adjacent pancreas was somewhat thickened. A dilated common duct was found, but was torn in the first attempt to pass a ligature around it. The duct was opened, cut across, and the upper stump ligated with silk. Clamps were applied to the duodenum well above and below the papilla of Vater, and the duodenum cut across. A wedge-shaped section of pancreas was then excised, cutting being done in front of clamps, as in a thyroidec-tomy. Hemostasis was effected, the pancreatic duct being recognized and included in one of the ligatures. An end-to-end anastomosis of the duodenum was easily accom-

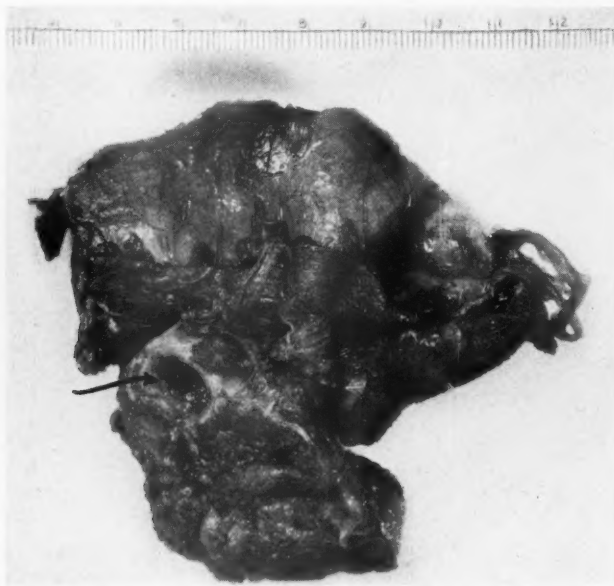


FIG. 2.—Rear view of specimen, showing enlarged common duct leading down to papilla.

plished because of the wide freeing of the duodenum and the partial removal of the pancreatic head. Mattress sutures of silk were used for the outer layer, and continuous catgut for the inner layer. The raw surface of the pancreas was closed with a large mattress suture. One Penrose drain was inserted lateral to the site of the anastomosis, the omentum being tucked around the anastomosis and over the surface of the pancreas. The operation took two and one-quarter hours. Except for a drop of blood pressure at the end of the first hour, controlled by a second injection of ephedrin and morphine, the condition was very satisfactory.

Persistent vomiting commenced on the first postoperative day, at first in small amounts. A nasal tube was inserted and the drainage by the second day amounted to 500 cc., in addition to 100 cc. of vomitus and considerable fluid obtained by lavage. For the next several days about two liters a day were vomited and then, on the seventh day, the vomitus and gastric lavage return exceeded three liters. The abdomen was distended and it was quite obvious that there was a high obstruction, either from constriction at the anastomosis, or, more probably, from traction against the superior mesenteric vessels.

August 29, the abdomen was again opened under pantocaine. The area of the

previous operation was not inspected. To attempt a posterior gastro-enterostomy might easily have disturbed valuable adhesions, so a long-loop anterior gastro-enterostomy, with an entero-enterostomy a comfortable distance below, was done. A transfusion was given at the close of the operation, notwithstanding the satisfactory condition of the patient.

A slow but excellent recovery was made. The blood amylase curve followed closely that found experimentally in ligation of the pancreatic duct, namely, a very high rise to 76 within the first 24 hours, followed by a gradual drop of values. There was considerable abdominal distension and some constipation, the stools tending to be bulky. Fluid obtained through a duodenal tube showed a rather powerful lipase and protease reaction, but no amylase. A good blood pressure was maintained and the patient was allowed out of bed on the twentieth postoperative day and home on the fifty-fourth, weighing 98 pounds.

*Pathologic report*, by Dr. A. P. Stout.—Gross—The specimen is a segment of the duodenum together with a portion of the head of the pancreas and the common duct.

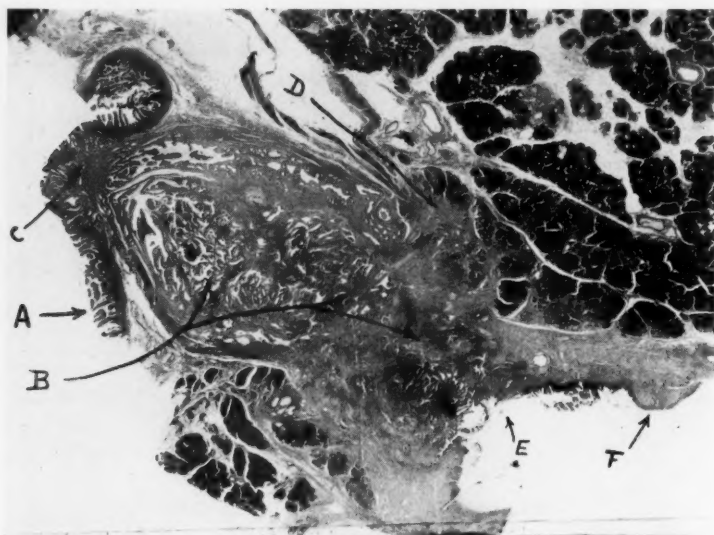


FIG. 3.—Low power photomicrograph showing: (A) Mucous membrane of duodenum. (B) Tumor. (C) Where tumor impinges on duodenal mucous membrane. (D) Where tumor is beginning invasion of pancreas. (E) Blind end of common duct. (F) Extension of tumor along mucous membrane of common duct.

After fixation in pyradine formol, the duodenal segment measures 9 cm. in length along the antimesenteric border. The duodenum seems relatively normal except for some fresh hemorrhage due to operative trauma. The papilla of Vater is represented by a nipple-like projection 5 Mm. in diameter (Fig. 1), covered with mucosa. No lumen can be found. Beneath it can be felt a hard mass which unites it with a common duct. A piece of common duct about 6 Mm. long has been removed. Through the line of resection it is much dilated (Fig. 2), measuring 1.5 cm. in diameter, but this quickly narrows to nothing as there is no communication with the duodenum. The termination of the duct is therefore cup-shaped and is surrounded by the head of the pancreas, which is 4 cm. long, 5 cm. wide, and 4 cm. thick.

A section through the pancreas, common duct and papilla shows that the termination of the duct is separated from the papilla by a firm, ovoid, pale yellow tumor about 1.2 cm. in its greatest diameter and 8 Mm. wide. The duodenal mucosa is intact over it, although seemingly it has involved the muscular coat of the duodenum.



# CARCINOMA OF PAPILLA OF VATER

Fixation in pyradine formol. Section through papilla, duct, pancreas, and adjacent duodenal wall. Small piece of tumor for quick diagnosis. One segment of pancreas fixed in Zenker.

A reexamination of the gross specimen shows a cut section of the pancreatic duct which passes through the pancreas near the common duct and seemingly loses itself in the tumor mass.

*Microscopic.*—A section taken through the papilla, the tumor, the duodenal wall, the end of the common duct, and the adjacent pancreas shows that the tumor extends from the duodenal mucosa to the bulbous end of the common duct. Laterally it is sharply circumscribed by the pancreas and the duodenal wall. It is composed of well differentiated glandlike structures which are lined with epithelial cells varying from cuboidal to columnar, most of which maintain their nuclear polarity. There is marked tendency for the cells lining some of the neoplastic glands to form papillary projections into their dilated lumens. Secretion of mucin is observed in many of the tumor cells. Mitoses average one in every three or four high power fields. The tumor glands apparently replace the duodenal glands on the papilla itself. They have invaded the adjacent muscularis of the duodenum and the muscular remnants of the obliterated common duct, but they have not extended to any appreciable distance, and the pancreas appears free. The section does not show any evidence of the pancreatic duct. The bulbous end of the common duct is lined with a papillary epithelial tissue which more nearly resembles the tumor than it does the duct epithelium.

This is apparently a well differentiated, mucin secreting adenocarcinoma of the papilla of Vater, probably arising from the mucosa of the common duct. It has obliterated and replaced the common duct for its terminal 11 Mm. Apparently it has been generously removed on all sides except along the common duct itself. Since the tissue lining this more nearly resembles the neoplasm than it does the normal mucous membrane, one has to fear a reappearance along the divided common duct.

Diagnosis: Carcinoma of the papilla of Vater.

*Follow Up.*—At first, the patient's appetite was ravenous, but with a gain in weight, aggregating 40 pounds in the four months since discharge, this has become normal. The patient has been doing some work. There is one bowel movement a day, the stool being of normal brown color, neither oily nor frothy; stool examinations, against a weighed diet, show fat and protein absorption as follows:

Days Postop.	Cho.	Diet		Percentage Absorbed	
		P.	F.	Protein	Fat
18.....	100	60	40	84%	64%
28.....	200	70	40	56%	58%
40.....	200	70	40	76%	64%
90.....	300	120	110	83%	88%

This would seem to indicate that the lipase which has been found in the gastric and intestinal contents has been sufficient to maintain a good margin in his favor.

## COMMENT

This case is presented as a successful six months' result of what we believe to be a new method of handling the problem of carcinoma at or around the papilla of Vater. A variety of procedures, involving reimplantation of the common duct or the stump of the pancreas have been tried with varying immediate and delayed success, as reported by Cohen and Colp, Walters, Muller and others. So far we have found no description of a procedure similar to the present one in the literature. Autopsy evidence indicates that growth from the original lesion is at first along the common duct

and into the neighboring pancreas, before distant dissemination occurs. In the early stages of the disease, complete eradication might be secured by free resection of the common duct below the cystic, of the duodenum including the papilla, and of the neighboring pancreas.

Because of its magnitude, the procedure must be done in two stages. The gallbladder should be anastomosed, not to the duodenum but to the stomach, to keep it as far as possible from the operative field at the second operation. In the case presented, one of the difficult steps was the isolation, ligation and section of the common duct at the second stage. This maneuver, therefore, should be carried out at the first operation, and the lower end marked by a ligature of black silk with the ends left long, to serve as a guide. Although anastomosis of the duodenum was extremely easy, this should not be done because of the great risk of obstruction. The duodenum withstands pressure or traction very poorly; and while an anastomosis may be competent, nevertheless there is very apt to be a drag set up against the superior mesenteric vessels. It is suggested that a gastro-enterostomy be done at the first stage.

At the second stage, done preferably after two or three weeks, there would be liberation of the duodenum and the head of the pancreas, with a liberal resection of the duodenum, and the removal of a wedge-shaped section of the pancreatic duct, plus the lower portion of the common duct. The possibility of employing this procedure must be considered in cases of jaundice from tumor, when the tumor is at or around the papilla and seems still to be localized.

The prognosis in the case shown would seem to depend on whether the section through the common duct was or was not above the limits of the tumor. From a physiologic standpoint, this patient's digestive apparatus is apparently functioning at a level of efficiency which would indicate that he is compensating adequately for the loss of his pancreatic ferments. There is, of course, no thought that his island tissue will degenerate.

DISCUSSION.—DR. GEORGE P. MULLER (Philadelphia) stated that although resembling in general plan several procedures described in the literature, that detailed by Doctor Parsons seemed to be much simpler and more satisfactory, having filled the requirements of a good technical procedure insofar as a period of six months indicates the permanency of the end-result. He described a similar case that he had treated ten years ago by a method then in vogue with Mayo and Stein. The duodenum was opened and the area of carcinoma thoroughly cauterized with the actual cautery, after which a rubber tube was inserted into the common duct and sewed in place to prevent stricture at the duodenal orifice. At the end of one year the patient was fine and the case was reported to the American Surgical Association as a one year cure. Subsequently, he again became jaundiced and a cholecystogastrostomy was performed. He remained well for several years, then within a brief period masses appeared in the upper abdomen and vomiting occurred. The patient was reoperated on but, owing to adhesions, the site of the original operation could not be uncovered. A gastro-enterostomy was done and he was well for awhile, but eventually died, four years and eight months after the original operation.

A second case was seen by Doctor Muller two years ago, a woman who

had had carcinoma of the breast five years previously. Because of jaundice, she was looked upon as a case of painless stone obstruction. At operation, however, no stone was discoverable. When the duodenum was opened carcinoma of the ampulla of Vater was found and removed by cautery, removing almost as much of the pancreas as was done in the case reported by Doctor Parsons. The tube was sewed into the common duct, but the patient was too sick to permit anything else to be done. A letter received from her a few weeks ago stated she was quite well.

In 1904, Doctor Muller reported a case discovered at autopsy and discussed the pathology of the pancreas. Notwithstanding the fact that no pancreas remained except a mass of fatty tissue in which the islets were completely preserved, dotted here and there in the fat, the patient had suffered no serious symptoms of indigestion. He felt that whereas possibly in the case reported by Doctor Parsons there was a good sized accessory duct, nevertheless it might be possible, also, that external secretion of the pancreas is unnecessary in the maintenance of reasonably good health.

DR. WALTER E. LEE (Philadelphia) stated in connection with reporting three cases from the Graduate Hospital of the University of Pennsylvania the literature on the subject of carcinoma of the ampulla of Vater was reviewed up until 1933, with only 36 completed reports and 17 references being found and accepted. The most impressive feature of the disease is the difficulty of making a preoperative diagnosis of it as the cause of common duct obstruction. Another important clinical feature in his three cases was the uncontrollable hemorrhage that appeared on the sixth and eighth postoperative days. Bleeding occurred then in practically all of the serous mucosa lined cavities. The marked preoperative jaundice was considerably relieved following the drainage of the common duct proximal to the obstruction, but the bleeding could not be stopped.

Although doubting that it would have been possible to have successfully included the procedure described by Doctor Parsons in any of the three cases operated upon, in view of preoperative conditions and doubt concerning the lesion, he felt that in the future this would be attempted. The fact that an individual can not only survive but live an apparently normal physiologic existence after ligation of the main pancreatic duct has made Doctor Parsons' procedure a logical one. Dividing it into two stages would seem to be absolutely necessary. These patients when they reach the surgeon are rarely in condition to stand a great deal of radical surgery and it might even be necessary in some instances to prolong it over three stages, (1) the cholecystogastrostomy, (2) the gastro-enterostomy, and (3) excision of the duodenum, involved ampulla and terminal portion of the common duct.

The procedure described by Doctor Muller, said Doctor Lee, would apply only to a small localized lesion of the ampulla. Doctor Parsons' contribution, he felt, had opened a new field and would offer hope for at least prolongation of life in a lesion hitherto generally considered inoperable.

DR. ALLEN O. WHIPPLE (New York) explained that one of the chief reasons it was deemed wise to carry out the operation described by Doctor Parsons in two stages was the deep jaundice of the patient. Patients stand even three procedures like cholecystogastrostomy, gastro-enterostomy and ligation of the common duct, he said, much better than if the duodenum is opened and the pancreas damaged for the reason that bleeding can be more adequately controlled. He learned a great deal from the first case in which he endeavored to carry out the procedure in one stage, attempting to implant the resected head of the pancreas into the duodenum. This he felt was a

very hazardous, useless operation because it involved doing the very worst thing that could be done to the pancreas, that is, to activate secretion coming out of the dissected area in the pancreas by duodenal secretion. The operations of Sauvé and Desjardins are done in one stage and are therefore very complicated, there being only one case in the literature in which the Desjardins technic has been applied which lived 11 months. In every experimental instance in Doctor Whipple's experience, there was digestion of the suture line if the pancreas was implanted into the duodenum.

As a result of his first case and of Doctor Parsons' case, the first stage operation was again done by Doctor Whipple three weeks ago in a patient still in the hospital. The patient went through the procedure exceedingly well, the jaundice has entirely cleared up and weight has increased. No attempt was made in the second stage to unite the duodenum. Instead, depending on the gastro-enterostomy of the first stage, the duodenum from close to the pylorus down to the area where the superior mesenteric vessels cross it, was removed with a wedge of pancreas. The specimen showed that all tumor tissue was separated by 2.5 cm. from the cut edge of the pancreas. The patient has continued to do very well. Although there has been a slight leakage of pancreatic juice, it has not been activated or irritating to the skin. When this operation is performed in these patients, there is already obstruction of the pancreatic duct, the pancreas has begun to atrophy, and pancreatic juice is not being excreted. Hence ligation of the pancreatic duct does not immediately throw them into pancreatic insufficiency.

### INTRA-ABDOMINAL APOPLEXY

KENNETH W. THOMPSON, M.D., AND JOHN E. DUNPHY, M.D.

BOSTON, MASS.

FROM THE SURGICAL CLINIC OF THE PETER BENT BRIGHAM HOSPITAL, BOSTON, MASSACHUSETTS

INTRA-ABDOMINAL apoplexy is the spontaneous rupture of an arteriosclerotic artery of one of the abdominal viscera. In this region it is the counterpart of cerebral hemorrhage, but whereas the latter condition is common, intra-abdominal apoplexy is either extremely rare or seldom recognized. In 1931, Green and Powers<sup>1</sup> reported such a case treated at the Peter Bent Brigham Hospital and summarized the records of five other patients which had been recorded prior to that time. Since 1931, two more reports of intra-abdominal apoplexy have appeared.<sup>2</sup> This communication is to record the second case of intra-abdominal apoplexy that has been seen at the Peter Bent Brigham Hospital. As far as can be determined, it is the eighth to be noted in the literature.

#### CASE REPORT

P. B. B. H., Surg. No. 46984. Mrs. C. R., a white woman, 62 years of age, entered the hospital July 26, 1934, because of abdominal pain and vomiting.

*Present Illness.*—Eighteen hours before admission the patient was awakened with severe pain in the left precordial and left upper abdominal regions. Shortly after the onset of the pain, which was constant and nonradiating, she was seen by her family physician, who found her in a state of collapse, with a systolic blood pressure of 130 Mm. of Hg., a rapid pulse and a cold moist skin. A preliminary diagnosis of coronary occlusion was made and morphine was administered. The pain gradually extended over the entire abdomen and soon was associated with nausea and attempts to vomit. Her bowels

## INTRA-ABDOMINAL APOPLEXY

did not move but she did pass flatus. A cardiologist was consulted and he referred the patient to the surgical service of the Peter Bent Brigham Hospital, because he found marked abdominal tenderness and spasm. His impression was that the patient was suffering from an acute abdominal condition. Morphine was again administered two hours before she was sent to the hospital.

*Past History.*—The patient was known to have had hypertension. She had suffered from bilateral cataract and glaucoma for seven years. Six years prior to admission a cerebral vascular accident had occurred, with a resulting hemiplegia that disappeared after two years. Six months before admission she had had an attack of abdominal pain lasting several hours, after which she vomited blood. During the two weeks prior to admission the patient had been suffering from increased fatigability, dyspnea, and gripping sensations in the precordium. Her blood pressure during this time averaged 170/100. Her general condition just prior to the present illness had improved after rest and digitalis therapy.

*Physical Examination.*—The patient was an euphoric, slightly disoriented, and almost totally blind elderly woman. The lungs were slightly emphysematous with dullness and numerous râles at the right base. The heart was slightly enlarged, the sounds were faint, and a systolic murmur was heard at the apex, the pulse was regular and of fair quality with a rate of 90, the blood pressure was 120/70. Abdominal distension was present but tympani was not marked; in fact, there was shifting dullness in the flanks. The entire abdomen was markedly tender, more so in the left upper quadrant than elsewhere. Some involuntary spasm was present but this was not striking. Pelvic and rectal examinations revealed vague general tenderness but otherwise contributed no further localizing signs. The extremities showed markedly tortuous and hardened arteries. There was no edema.

*Laboratory Studies.*—The blood showed 4,000,000 erythrocytes; the leukocyte count was 18,700, with a differential of 93 per cent polymorphonuclear cells. Examination of the urine was negative except for the presence of hyaline casts. Blood Wassermann and Hinton tests reported later proved to be negative. Roentgenograms with fluoroscopy of the chest and abdomen demonstrated a moderate amount of fluid in both abdominal and pleural cavities, but the heart was not markedly enlarged. Electrocardiograms, including a fourth lead, were not suggestive of coronary occlusion.

*Preoperative Course.*—The patient was observed because of a suspicion of a non-operable cardiovascular condition, but after waiting for two hours, spasm and tenderness of the abdomen had increased, and laparotomy was advised. The preoperative diagnosis was mesenteric vascular occlusion.

*Operation.*—July 27, 1934. Abdominal exploration with evacuation of hemoperitoneum. Ether anesthesia. A right paramedian incision disclosed a large amount of liquid blood free in the peritoneal cavity. Sheets of clotted blood were found in the left upper abdomen extending down over the omentum from the region of the stomach. The gastrohepatic omentum was a greatly thickened, hemorrhagic mass. No free bleeding was seen, but the source of hemorrhage obviously had been an artery in the gastrohepatic omentum. There was no evidence of acute pancreatitis, perforated ulcer or malignancy. Most of the clots and liquid blood were evacuated from the abdomen, and after the fact was established that no fresh bleeding was taking place, the wound was closed without drainage. The patient stood the procedure fairly well, although the blood pressure dropped to 70/50 and the pulse rose to 130 during the exploration.

*Postoperative Course.*—Recovery from the operation was prompt, and the convalescence was uneventful except for a recurrence, during the second week, of mild abdominal pain associated with tenderness, chiefly in the right lower quadrant, accompanied by a slightly lowered blood pressure which lasted for several days. The possibility of a recurrence of hemorrhage was considered, but the symptoms soon ceased and convalescence again became very satisfactory. The patient was quite well six months after operation, and she has had no recurrence of abdominal symptoms.



## COMMENT

This case conforms exactly to the condition described as abdominal apoplexy by Green and Powers. The appearances of the gastrohepatic ligament of the two cases that have been seen in this surgical service are almost identical. In the instance herein described hemorrhage was more extensive but had ceased before laparotomy was performed.

Although the condition of intra-abdominal apoplexy appears to be surgical, and ligation of the ruptured vessel is to be desired, the successful course of this particular patient demonstrates, as in hemorrhage from duodenal ulcer, that actual ligation of the vessel may not be necessary, if the bleeding can be controlled by conservative medical measures. A larger incision and a very careful search of the entire gastrohepatic omentum, as would have been necessary in order to find the ruptured vessel in this instance, might have prolonged the operation sufficiently to have caused a fatality.

## SUMMARY

A second case of intra-abdominal apoplexy is reported. Diagnosis was made by abdominal exploration. The patient recovered. This appears to be the eighth such case to be reported in medical literature.

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- <sup>2</sup> Mourgue-Molines, E., and Cabanac.: Abondante hémorragie intra-péritonéale par infarctus de l'épiploon-gastro-hépatique. *Bull. et. mem. soc. nat. de chir.*, vol. 59, pp. 720-727, May, 1933.

## RETROPERITONEAL CHYLE CYST

SIEGFRIED F. STRAUSS, M.D., AND BERNARD E. SAYRE, M.D.

CHICAGO, ILLINOIS

CHYLE cysts are unusually rare, those of the mesentery have been found occasionally but a search of the literature does not reveal a single instance of retroperitoneal chyle cyst in the region of the cysterna chyli.

## CASE REPORT

A female, 38 years old, March 4, 1934, suffered a severe attack of pain along the right side of her spine in the region of the first and second lumbar vertebrae, which radiated anteriorly to the upper right quadrant. She did not vomit but felt very nauseated and complained of headache. She had noted a marked loss of weight in spite of a very good appetite and forced feedings. Present weight 113 pounds, two years previously 140 pounds. Constipation marked, necessitating mineral oil daily. She also felt extremely weak and fatigued at the end of her day's work. At times she had a feeling of pain in the upper abdomen, not associated with food. Belching and distension after meals was not pronounced. Her past history was essentially negative. She had never been acutely ill before.

*Examination* showed a rather thin individual who appeared acutely ill. Head and neck negative. Eyes reacted to light accommodation. Heart and lungs appeared normal. Examination of the abdomen revealed a marked rigidity in the right upper quadrant. Pressure over the gallbladder region elicited extreme pain anteriorly which radiated posteriorly. Pulse 80. Temperature 98°. Blood pressure 115/80. The symptoms and physical findings suggested a possible gallbladder colic and she was advised to rest in

# RETROPERITONEAL CHYLE CYST

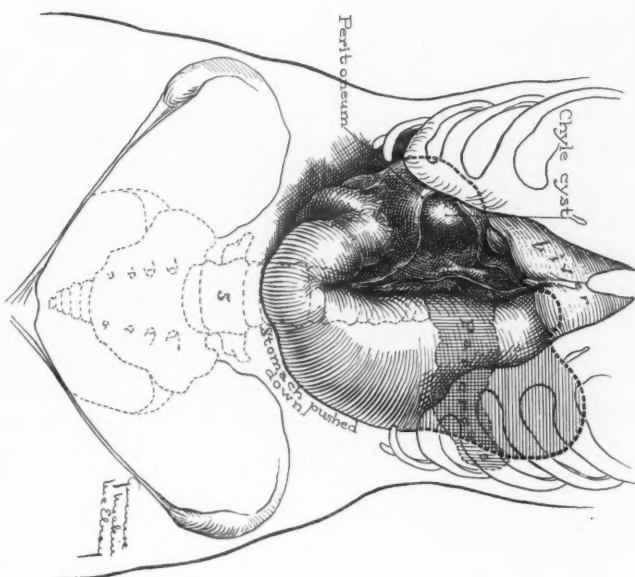


FIG. 1.—Showing the relative situation of the cyst retroperitoneally and the adjacent viscera.

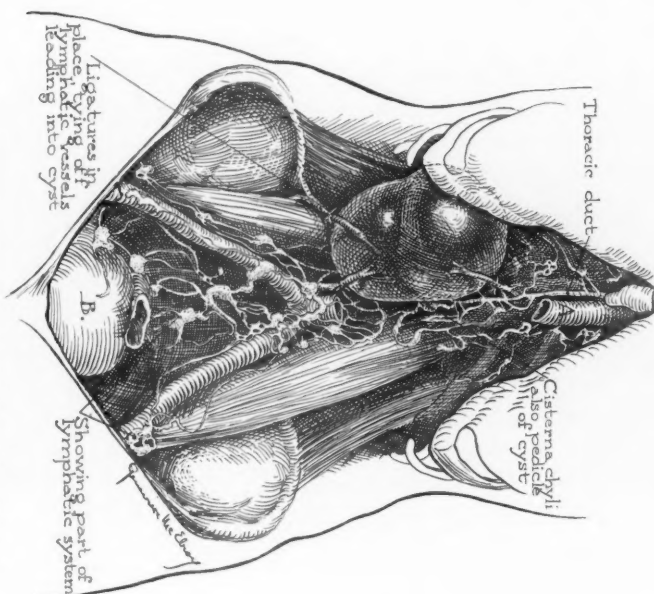


FIG. 2.—Showing the three large vessels entering the cyst.

bed with an ice bag applied to the abdomen. The next day her acute pain had entirely disappeared, but there still remained a dull ache in the right upper quadrant. Palpation demonstrated a distended hard mass in the upper right quadrant about the size of an orange, which was very tender to pressure and which moved slightly with respiration. The urine did not contain bile and the sclera was clear. A diagnosis of a stone blocking the cystic duct with a hydrops of the gallbladder was made.

Four days later all pain had disappeared and the distended mass had become somewhat less tense. She entered the Michael Reese Hospital March 9, 1934. The red, white and hemoglobin count were normal. The Wassermann test was negative, coagulation time seven minutes. Calcium chloride was given intravenously and on the morning of operation 15 units of parathormone was administered hypodermically. The coagulation time decreased to four minutes.

*Operation.*—Upon opening the abdomen, a mass presented about the size of a grapefruit impinging on the anterior abdominal wall. The tumor was retroperitoneal and seemed to extend backward to the vertebral column. The gallbladder and liver formed its upper right border; the stomach and duodenum its left and inferior border (Fig. 1).

The peritoneum and tissues overlying the cyst were incised, which loosened the mass down to its base which appeared to be attached to the tissues overlying and to the right of the vertebral column. Anteriorly, there were three large vessels leading into the cyst which seemed to be dilated lymphatics (Fig. 2). The size of the cyst was reduced by aspiration and was found to contain a milky white fluid resembling chyle. This was verified on microscopic examination. The lymphatic vessels leading into the cyst were doubly ligated and divided. The base of the cyst was freed and removed. The lymphatic vessels that were cut seemed to lead upward and downward to the right of the aorta and apparently drained into the cisterna chyli. A drain was inserted to the base of the cavity. The patient made an uneventful recovery, and was discharged on the tenth day. There was never any drainage. Six months after the operation the patient had gained 15 pounds and she appeared in perfect health.

#### CONCLUSIONS

A search of the literature reveals no report of a retroperitoneal chyle cyst of this nature. This case is not to be confused with mesenteric chyle cysts of which there are some 96 on record.

The following phenomena are of interest.

- (1) Her severe pain in the back to the right of the spine.
- (2) Severe pain on pressure anteriorly and posteriorly.
- (3) Normal pulse and temperature throughout the attack.
- (4) Her marked loss in weight from 140 to 113 pounds with fatigue and general weakness.
- (5) Its relatively simple extirpation.

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Walter Estell Lee, M.D.  
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